

ORGANISING PNEUMONIA

A Clinical and Pathological Study of Fifty Cases

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The study of the fifty patients reviewed in this thesis was undertaken while I held the post of Registrar to the Respiratory Diseases Unit, Northern General Hospital, Edinburgh. I am indebted to Dr. I.W.B. Grant, Consultant Physician, who first suggested this study and who provided encouragement and guidance. I have to thank Professor J.W. Crofton of the Chair of Tuberculosis and Diseases of the Respiratory System, University of Edinburgh, and Dr. I.W.B. Grant for allowing me access to patients under their care. The two patients treated with prednisolone were seen after the main study was completed. They were under the care, respectively, of Dr. J. A. Strong, Consultant Physician at the Western General Hospital, Edinburgh, where I held the post of Senior Medical Registrar, and of Professor S. Alstead of the Chair of Materia Medica and Therapeutics, University of Glasgow, at Stobhill General Hospital, Glasgow, during tenure of my present post as Lecturer in Materia Medica, University of Glasgow. I thank both these physicians for permission to report these cases.

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DISCUSSION

Since the diagnosis of cerebral arteriosclerosis and its complications was accepted as essential to the practice of medicine it has been found that satisfactory prognosis of the lungs is not always possible. The first really adequate clinical record of this phenomenon is that of Jones in 1889. Although numerous studies have been made since that time and many practical attempts, especially since radiography has been available for examination of the lungs, the pathogenesis is still in doubt and the associated terminology has become confusing.

Clinical and pathological descriptions of pulmonary disease similar to that of the present study have been included under such titles as "arteriosclerotic pneumonia" (Nicholson 1906; Brown 1910), "chronic pneumonia" (Wells 1911; Hedberg 1912), "chronic pneumonia" (Gibbell, Miller and Reed 1919; Vassalli, Bouché and Brown 1924; Brown 1928), "organizing pneumonia" (Wells 1923; Reed 1925), "chronic interstitial pneumonia" (Brown 1926), "chronic non-specific pneumonia" (Brown 1928; Brown and Reed 1929), "chronic non-specific organizing pneumonia or pneumonitis" (Brown and Reed 1929; Brown and Reed 1930).

INTRODUCTION

Since the discipline of careful observation and logical deduction were accepted as essential to the practice of medicine it has been known that inflammatory processes of the lungs do not always resolve completely. The first really adequate clinical account of this phenomenon is that of Laennec in 1819. Although numerous studies have been made since that time and much knowledge accrued, especially since chest radiography became available for examination of the lungs, the pathogenesis is still in doubt and the associated terminology has become confusing.

Clinical and pathological descriptions of pulmonary disease similar to those to be given in this study have been included under such titles as "suppurative pneumonia" (Nicholson 1950; Erasmus 1954), "chronic pneumonia" (Milne 1911; Scadding 1938), "chronic pneumonitis" (Waddell, Sniffen and Sweet 1949; Cesanelli, Kozameh and Hassan 1954; Sanborn 1958), "organising pneumonia" (Kidd 1912; Lord 1925), "chronic interstitial pneumonitis" (Gross 1960), "chronic non-specific pneumonitis" (Deaton 1958; Kusagawa and others 1959), "chronic non-specific suppurative pneumonia or pneumonitis" (Kershner and Adams 1948; Desai and Leroux /

Leroux 1953), "spreading suppurative pneumonitis" (Sellors and others 1946), "chronic suppurative foam-cell pneumonia" (Chiari 1951), "fibroid diseases of the lung" (Clark, Hadley and Chaplin 1894) and "pulmonary fibrosis secondary to pneumonia" (Auerbach, Mims and Goodpasture 1952). Faced with such obviously different concepts of the disease process, it becomes imperative to attempt some precise definition. The steps leading to this definition are explained below.

The cases to be discussed here were admitted over a period of five years to a hospital unit specialising in respiratory diseases. They form the majority of a group of seventy-two patients (Table 1) whose illness had been labelled originally "suppurative pneumonia" either acute or chronic. Two of these patients were eventually found to have pulmonary tuberculosis, one to have an infected pulmonary cyst and one to have bronchial carcinoma. On clinical and radiological grounds, eight patients clearly belonged to the "acute" group. Each had pulmonary cavitation and on antibiotic therapy all showed virtually complete radiological healing with only minimal fibrotic opacities persisting in a minority. These cases are perhaps more commonly designated "acute lung abscess". Difficulty was experienced with a further group of patients whose chest radiographs cleared very slowly but eventually did become normal. These cases are examples /

examples of the well-known entity "pneumonia with delayed resolution". The typical radiological appearances are shown in Figure 1 (a, b and c).

When all the above cases had been excluded a group of fifty patients remained. A few had evidence of abscess formation but could be readily differentiated from the acute lung abscess group by their chronicity. The others could be differentiated from the cases of pneumonia with delayed resolution only by radiological observation. It was found that where resolution had not taken place by six months, radiographic changes of a fibrotic type were permanent. It seems reasonable therefore to postulate an essential criterion of organising pneumonia by re-stating these facts as follows: Organising pneumonia, with or without suppuration, can be diagnosed only in retrospect by observation for a period of at least six months and the demonstration of lung damage of a type which can heal only by fibrosis. It is on the basis of this statement that the following fifty cases are presented.

CLINICAL ASPECTS

The details of the individual cases are given in the Appendix.

Age, Sex and Seasonal Distribution.

It is of interest that males predominate in the proportion of 4:1 (40:10) and that although there is no preponderance of females in any one age group it is the middle-aged and elderly man who is most often affected; over seventy-five per cent of the men are in the fifty-one to seventy age group (Fig. 2).

The greatest number of cases occurred during the month of December and in the six month period October to March thirty-five cases (i.e. seventy per cent of the total) were seen (Fig. 3).

Symptoms and Physical Findings.

The clinical picture varied widely. At one end of the scale the illness was mild with few systemic features and no significant sequelae and at the other a prostrating illness with permanent and disabling disturbance of lung function.

The common clinical features (Fig. 4) included cough and expectoration which were practically invariable and pleuritic pain /

pain which occurred in about fifty per cent of patients. Significant dyspnoea was experienced by twenty patients, considerable weight loss (more than 7 lb.: 15.4 kg.) was seen in ten patients and three patients complained of night sweats. Haemoptysis, usually consisting of blood streaking of the sputum but occasionally being moderate in amount, occurred in thirteen patients. Twenty-nine patients experienced an acute onset to their disease.

Finger clubbing was present in ten patients; in only two was there associated disease which could have accounted for this. The physical signs on examination of the chest were commonly those of pulmonary consolidation. Localised crepitations and slight dullness to percussion frequently persisted for prolonged periods. In some patients, however, abnormal physical signs had disappeared despite the persistence of a radiological opacity.

Previous Respiratory Diseases and Associated Illnesses.

Only fourteen patients had had no previous significant respiratory illness (Table 2). On the other hand, twenty-four suffered from chronic bronchitis of varying severity. Ten had had pneumonia previously but only two had bronchiectasis.

There /

There was one instance each of mitral stenosis, epilepsy, nephrolithiasis, idiopathic steatorrhoea, Addisonian pernicious anaemia, iron deficiency anaemia, diabetes mellitus and essential hypertension. Five patients had proven duodenal ulcers.

Upper respiratory tract and dental operations sometimes precede acute lung abscess but no such procedures had been undertaken before the onset of illness in these patients.

Erythrocyte Sedimentation Rate (E.S.R.) and White Cell Count (W.C.C.).

The E.S.R. was done in twenty-seven instances and was raised in eighteen; in ten it was over 80 mm. in one hour. The W.C.C. done on thirty-four patients was raised in fifteen.

BACTERIOLOGY OF SPUTUM

In the majority of cases bacteriological examination of the sputum was carried out before starting treatment in hospital. Most commonly, growths of mixed upper respiratory tract organisms were reported and pure growths of other organisms were uncommon (Table 3).

RADIOLOGICAL APPEARANCES

Not surprisingly, the commonest radiological appearance was consolidation (Table 4). Less than one third had associated atelectasis. Eight had cavitation, sometimes multiple, this being demonstrated usually by tomography. Three patients had associated pleural effusions. There was evidence of residual fibrosis in all patients except those submitted to surgical treatment. This finding, however, merely reflects the selection implicit in the definition given earlier. One patient had bilateral disease. The right lung was affected twice as commonly as the left and the right upper was the most frequently affected lobe. After the initial clearing of the radiograph, bronchography was performed in eighteen patients. Bronchiectasis was demonstrated in nine patients and bronchial distortion not amounting to bronchiectasis in another six cases. Bronchial abnormalities were therefore found in over eighty per cent of cases examined. Some of these radiological appearances are illustrated in Figures 5 to 8 and also in the section dealing with illustrative cases (Figs. 12, 13, 14, 16 and 18).

BRONCHOSCOPY

Bronchoscopy to exclude carcinoma was performed on most of these patients (forty-two). In a few instances, pus was seen /

seen issuing from the appropriate segmental bronchus, which was also in a few instances seen to have reddened mucosa at its orifice. Apart from these points, no abnormality was found.

PATHOLOGY

The specimens of lung for histological examination were obtained at autopsy on two patients and at thoracotomy on seven patients. The two deaths were from conditions other than the pneumonia, namely, pulmonary embolism in a seventy year old man and cerebral thrombosis in a sixty-nine year old woman. There were two reasons for advising thoracotomy; in four instances it was thought the patient had bronchial carcinoma and in three, resection of the diseased lung was carried out because of persistence of symptoms despite medical treatment.

Macroscopic Appearances.

Perhaps the most striking feature on naked eye examination of these specimens was the thickening of overlying pleura; this was invariable and in some to a degree making the serous membrane white and opaque. Occasionally the pleural cavity was obliterated by adhesions. The lung parenchyma was firm in /

in consistence, sometimes rubbery to the palpating finger, sometimes nodular and gritty. Fibrosis was obvious on the cut surface, as were areas of consolidation at the stage of "grey hepatisation". Cavities were seen in three specimens; in one they were numerous and irregular. In three instances the segmental bronchi in these areas were dilated and had thickened walls.

Microscopic Appearances.

The one invariable feature of the histological picture was fibrosis. This was frequently dense and entirely replaced alveoli; sometimes it was seen apparently replacing an alveolar inflammatory exudate and sometimes it was confined to interstitial tissue giving rise to diffuse thickening of alveolar walls and septa. Infiltration with chronic inflammatory cells was usual. Lymphocytes sometimes occurred in aggregates, especially around bronchi, and less commonly the predominant form was the plasma cell. In areas not so markedly affected, the alveoli were lined by cuboidal or columnar epithelium; this metaplasia is sometimes described as "foetalisation". The bronchial walls were commonly the site of chronic inflammatory changes; in one case there was ulceration of the mucosa. Blood vessel walls tended to be thickened when involved in the chronic inflammatory process. One of the cavities contained a thick growth of fungus /

fungus morphologically similar to the *Aspergillus fumigatus* and presumably a secondary invasion of the air space. In two cases, macrophages containing lipoid material were seen crowding alveoli.

Any of the above features might dominate the individual case. Very often they might be seen in different parts of the same lung. The complete picture suggested the organisation of pneumonia, with or without suppuration, at different stages of advancement. These changes are shown in Figures 9, 10 and 11 and also in the section on Illustrative Cases (Figs. 15, 17 and 19).

TREATMENT

The majority of patients received medical treatment with antibiotics; three with persistent cough, expectoration of purulent sputum and general ill-health despite medical treatment had surgical resection of the diseased segments of their lungs carried out. Each of these patients was thereby rendered symptom free.

It was usual that a sulphonamide or an antibiotic had been given before admission to hospital. After admission several patients were treated with one of the tetracyclines, chloramphenicol or streptomycin where they were /

were considered bacteriologically appropriate. The mainstay of treatment, however, was benzylpenicillin given intramuscularly generally in a dose of 2 mega units daily. Except for the three patients mentioned above, systemic evidence of infection and purulent sputum cleared fairly rapidly. The clearing of the radiological opacity was less consistently related to antibiotic therapy. From Table 5 it can be seen that some patients received relatively short courses of penicillin yet continued to show slow radiological clearing after treatment was stopped. For example, seven patients received penicillin from one to four weeks but continued to clear their pulmonary opacities for twenty-four or more weeks. The "residual lesion" referred to here means the radiological appearance beyond which there is no improvement.

FOLLOW-UP STUDY

An attempt was made to see all patients personally, in order to assess respiratory symptoms and obtain a further chest radiograph. Of the forty-eight patients who had left hospital, thirty-five (seventy-five per cent) were seen. The reasons for not attending for follow-up examination are given in Table 6. None of the five deaths was related to the pneumonic illness. Those followed up were seen at intervals ranging from six months to five and a half years from their illness.

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The majority (nineteen) had no respiratory symptoms; six of these had had resection of their diseased lung. Sixteen had slight to moderate degrees of cough, expectoration and dyspnoea; these were patients who had had respiratory symptoms before the pneumonic illness and who considered their symptoms no worse after it. Only one patient was undoubtedly worse.

Symptoms at the time of follow-up examination were related to the presence or otherwise of bronchial abnormalities demonstrated by bronchography. In fact, as can be seen from Table 7, these abnormalities caused by organising pneumonia do not appear to be of importance in producing respiratory symptoms or rendering the patient more liable to respiratory illness.

ILLUSTRATIVE CASES

The following cases have been selected to show the main clinical and radiological points which have already been made.

A. (Case 35) Severe illness with considerable sequelae.

<u>Name</u>	<u>Age</u>	<u>Occupation</u>
Mr. D.U.	65 years	Retired Joiner

This patient had had symptoms of mild chronic bronchitis for many years. He was admitted to hospital in January 1958, seven weeks after the sudden onset of fever, increased cough and purulent sputum. He was confined to bed at home and received courses of tetracycline and chloramphenicol. Although his sputum gradually became mucoid he continued to feel weak, lost weight and found he was breathless on only moderate exercise.

On admission to hospital he was afebrile. There was evidence of weight loss but no lymph-node enlargement and no finger clubbing. In the chest there were signs of consolidation in the left upper lobe and crepitations and a few rhonchi were heard over both lungs. The other systems were clinically normal. The E.S.R. was 9 mm. in one hour and the W.C.C. 12,900/c.mm. The /

The sputum was reported as giving a growth of mixed upper respiratory tract organisms.

A chest radiograph revealed a dense opacity considered to be due to consolidation and collapse in the left upper lobe (Fig. 12b). The left hemidiaphragm was raised and on screening of the chest was seen to be paralysed. Tomography did not show any cavitation. On subsequent radiographs there was only slight and slow improvement with probably an increasing degree of collapse (Fig. 12c). Bronchoscopy was negative.

Further antibiotics were given in the form of benzylpenicillin 2 mega units daily by intramuscular injection for four weeks and tetracycline 2G. daily by mouth for six weeks. He gradually felt stronger, became less breathless and regained his lost weight.

He was seen for assessment in December 1959, two years after his illness. He complained of persistent cough, mucoid sputum, wheeze and exertional dyspnoea and considered that his symptoms had been much worse since his acute illness. A chest radiograph showed little change; the left upper lobe was still collapsed and fibrosed and the left hemidiaphragm /

hemidiaphragm raised (Fig. 12d). It is worthy of note that a chest radiograph taken in 1957 (Fig. 12a) at a routine medical examination was within normal limits.

B. (Case 31) Mild illness with minimal sequelae.

<u>Name</u>	<u>Age</u>	<u>Occupation</u>
Mr. F.C.	64 years	Cinema Attendant

Three months before his admission to hospital in April 1956 he developed unproductive cough and slight dyspnoea. Soon after this he produced purulent sputum but was able to carry on with his work. Because of the persistence of respiratory symptoms, however, he was sent by his own doctor to a Mass Miniature Radiography Unit. The report from this unit recommended that the patient be referred to a Medical Outpatient Department whence he was admitted to hospital.

He appeared a healthy man and indeed apart from diminished air entry and a few crepitations over the right lower lobe, there was no abnormality on clinical examination. The E.S.R. was 4 mm. in one hour and the W.C.C., 9,600/c.mm. There was no bronchoscopic abnormality. Bacteriological examination /

examination of the sputum revealed a growth of mixed upper respiratory tract organisms only. The chest radiograph (Fig. 13a and b) showed consolidation in the apical and lateral basal segments of the right lower lobe.

Two mega units of benzylpenicillin were given daily by intramuscular injection for eight weeks and chloramphenicol 2G. daily by mouth for one week. There was considerable although slow radiological clearing.

When seen in December 1959, almost four years after his illness, he denied symptoms and the chest radiograph showed only streaky, fibrotic opacities in the right mid zone.

C. (Case 40) Illness thought to be due to bronchial carcinoma; thoracotomy.

<u>Name</u>	<u>Age</u>	<u>Occupation</u>
Mr. J.B.	52 years	Cooper

In April 1958 this patient experienced the fairly sudden onset of shivering and cough with blood-streaked muco-purulent sputum. He complained of some malaise and a few days later experienced left-sided pleuritic pain. Penicillin was given at home and he improved to the extent that /

that he was able to return to work after a period of three weeks. Because of the slight haemoptysis he was referred by his own doctor to a chest clinic whence he was admitted to hospital on 15th May.

He showed no evidence of weight loss and was afebrile. There were no enlarged lymph nodes and he had no finger clubbing. There was no clinical abnormality in the chest. Apart from a mild hypertension of 150/100 mm. mercury the other systems were normal. The sputum was not examined bacteriologically. The bronchoscopic appearances were entirely normal. The chest radiograph showed a left perihilar and mid zone opacity seen to be, on the lateral film, in the apical segment of the lower lobe (Fig. 14a and b). After admission to hospital he was given benzylpenicillin 2 mega units daily by intramuscular injection for seventeen days. At the end of this period the chest radiograph showed no significant improvement.

Thoracotomy was performed on 12th June 1958. A frozen section was made of the diseased tissue and reported as showing "chronic inflammation and fibrosis". Resection of the apical segment of the left lower lobe was carried out.

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The resected specimen was covered on one surface by pleura which showed fibrous thickening. Deep to this the lung tissue was firm, greyish and had a streaky pattern; elsewhere the lung was spongy and apparently normal. The segmental bronchus showed no evidence of obstruction, neoplasm or bronchiectasis. Microscopically there was patchy replacement of alveolar tissue by dense fibrous tissue (Fig. 15a). The scattered alveoli still remaining showed cuboidal epithelial metaplasia of the lining membrane (Fig. 15b). There was marked inflammatory cell infiltration mainly by plasma cells.

In November 1959 the patient was seen again. He was well and the chest radiograph was satisfactory.

D. (Case 9) Persistence of respiratory symptoms. Thoracotomy and resection of diseased lung.

<u>Name</u>	<u>Age</u>	<u>Occupation</u>
Mr. P. McI	28 years	Coal Miner

This young man admitted to having had a "smoker's cough" for ten years. This consisted of slight morning cough with the production of a trace of white, frothy sputum.

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In March 1955 cough became worse and produced purulent sputum. He denied feeling particularly unwell but was off work for five weeks. He was given no antibiotic or chemotherapy at this time. He was seen as an outpatient at a chest clinic and found to have a radiological pulmonary opacity. When, after treatment with 1 mega unit of penicillin by injection daily, there had been no improvement after ten days, he was admitted to hospital on 23rd May 1955.

On physical examination his general condition was satisfactory. There were a few medium crepitations at the right base and axilla. Percussion note was impaired and air entry was diminished over this area. He had early finger clubbing but no other abnormality on clinical examination. W.C.C. was 10,400/c.mm. Sputum which was purulent and amounted to 20-60 ml. per day gave a growth of mixed upper respiratory tract organisms and coagulase negative staphylococci. A chest radiograph showed consolidation in the right middle lobe and in the anterior and posterior segments of the right upper lobe (Fig. 16a). Tomograms showed several small (0.5-1 cm.) cavities within the consolidated area. Bronchoscopy was negative.

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It was decided to treat this patient with high doses of antibiotics. He received 4 mega units of penicillin by injection daily for eight weeks from May to July, chloramphenicol 2G. daily for one week in July and penicillin again in a daily dose of 2 mega units from July to October. Despite this, cough and purulent sputum persisted and the radiological clearing was slow (Fig. 16b) and indeed was only moderate in extent over the twenty-four week period of observation and treatment. In October a bronchogram was performed which showed distortion and dilatation of the bronchi of the right middle lobe and anterior segment of the upper lobe (Fig. 16c). Right upper and middle lobectomy was performed on the 7th November 1955 because of persistent respiratory symptoms and unsatisfactory radiological progress.

The naked eye appearance of the cut surface of the resected specimen suggested gross fibrosis of the lung parenchyma. Bronchi had thickened whitish walls, and some were dilated; the overlying pleura was thickened. Histologically there was a composite picture of fibrosis, diffuse thickening of alveolar walls and septa and aggregations of lymphocytes especially around the bronchi (Fig. 17a and b).

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The patient was seen again, four years after his operation, in November 1959. He was well and at work and had no significant respiratory symptoms. The chest radiograph was satisfactory.

E. (Case 36) Illness with moderate symptoms. Death from unrelated disease.

<u>Name</u>	<u>Age</u>	<u>Occupation</u>
Miss A.B.	69 years	Retired Typist

This old lady was admitted to hospital in March 1957. Two weeks before, she had developed an upper respiratory tract infection followed by cough and muco-purulent sputum. She also had some anorexia and vomiting and had lost a small amount of weight. She also gave a history suggestive of mild chronic bronchitis and emphysema.

She was a rather frail and febrile old lady. There were typical signs of pulmonary consolidation in the right lower lobe and occasional rhonchi over both lung fields. There was no finger clubbing and no other relevant finding on physical examination. W.C.C. was 9,500/c.mm. and E.S.R. 14 mm. in one hour. Sputum was scanty and grew mixed /

mixed upper respiratory tract organisms only.

The chest radiograph (Fig. 18a) confirmed consolidation in the right lower lobe. Bronchoscopy was not performed.

Her temperature became normal within seventy-two hours and her sputum entirely mucoid in two weeks but despite penicillin 2 mega units daily for five weeks and chloramphenicol 2G. daily for one week the radiological opacity cleared only slightly during the course of three to four months (Fig. 18b). She was transferred to a Geriatric Hospital and died there in January 1958 following a cerebral thrombosis.

At autopsy the right lower lobe was firm and rubbery to palpation. The microscopic picture was that of unresolved bronchopneumonia (Fig. 19). Large areas of lung were consolidated, the alveoli containing polymorphs and lymphocytes along with fibrin and hyaline material. In some parts there was congestion and infarction due to pulmonary arterial thrombosis following the infection. Over wide areas there was re-epithelialisation of the alveolar walls.

DISCUSSION

One of the most important questions that arise in the study of the structure of the group G is whether or not it is solvable. In this paper we shall show that G is solvable if and only if it is a subgroup of the group of upper triangular matrices over a field of characteristic p . This result is a special case of a more general theorem which states that a group G is solvable if and only if it is a subgroup of the group of upper triangular matrices over a field of characteristic p .

DISCUSSION

One of the most important questions that arise in the study of the structure of the group G is whether or not it is solvable. In this paper we shall show that G is solvable if and only if it is a subgroup of the group of upper triangular matrices over a field of characteristic p . This result is a special case of a more general theorem which states that a group G is solvable if and only if it is a subgroup of the group of upper triangular matrices over a field of characteristic p .

INTRODUCTION

One of the most pertinent questions that has to be answered is whether the cases described here constitute a clinical or pathological entity. Can we accept that the mild and severe cases are at opposite ends of a spectrum covering the same clinical picture? Can we regard the different pathological appearances as being manifestations of the same aetiological process?

If one again considers the original group of seventy patients from which these fifty were drawn, it becomes obvious that it was a heterogeneous group with, in many instances, little evidence of suppuration to justify the title "suppurative pneumonia". Suppuration results when the dead tissue in an inflamed area undergoes softening and liquefaction. When this occurs in lung tissue as an acute process, it is readily recognised, particularly by radiography when abscess formation has taken place. The label "acute suppurative pneumonia" therefore seems a reasonable alternative to acute lung abscess. "Chronic suppurative pneumonia" is a less precise title. It is understandable that such conditions as bronchial carcinoma, tuberculosis and infected bronchial cyst should be mistakenly included in such a group of patients; but the justification for excluding - on clinical grounds - those I have regarded as cases of pneumonia with delayed resolution /

resolution, is less obvious. Some of them resemble the cases reported here very closely, but with the one important difference of complete radiological resolution in the former.

Having isolated the group of "chronic suppurative pneumonias" in such a way, to what extent can this designation be justified? Cavitation was seen radiologically in only eight instances and in only three of the lung specimens examined histologically. Cavitation may have occurred in some of these patients who recovered satisfactorily and in whom it was not seen radiologically but the fact that this feature was not invariable is borne out by reference to the other lung specimens examined after surgical resection or at autopsy. The clinical features of suppuration, both local and systemic were also lacking in many patients. The common pathological denominator appeared to be replacement of chronic inflammation by fibrous tissue. In the patients coming neither to operation nor to the post-mortem room, I am accepting that the persisting pulmonary radiographic opacities represent fibrosis following pulmonary infection. Therefore, the label "organising (or organised) pneumonia" seems entirely appropriate and it would also appear reasonable to add "with or without suppuration" as the case may be. Regarded in this light and not as "chronic suppurative pneumonias", these cases can be discussed as an entity as I shall attempt to do and, in addition, make reference to the pertinent literature.

THE FREQUENCY OF ORGANISING PNEUMONIA

All statements regarding the frequency with which this condition occurs are necessarily hedged with reservations. In the five year period during which these fifty patients were investigated, a total of 4,137 patients with respiratory disease were seen at the same hospital unit. Of these, 419 had pneumonia of all types. An incidence of 1 in 8.3 (11.9 per cent), may be too high, as this type of case naturally tends to be referred to a unit specialising in respiratory disease for investigation and treatment. On the other hand, figures from general hospitals elsewhere and from other studies, both clinical and pathological, tend to include the cases I have designated "pneumonia with delayed resolution".

Most text-books have little to say on the subject. Scadding in "Diseases of the Chest" (Edited by Marshall and Perry 1952) states that with regard to pneumococcal pneumonia "carnification is so rare as to constitute a pathological curiosity; but in fatal cases small areas in which the exudate is organising are not infrequently found histologically". Quoting experience with pneumococcal pneumonia /

pneumonia is not, I think wholly irrelevant as most authorities claim that over ninety per cent of bacterial pneumonias are still caused by the pneumococcus (Rubin 1961). Bennett, in "Principles of Internal Medicine" (Edited by Harrison 1958), merely comments that "sometimes the involved area never becomes re-aerated and fibrosis results". Rubin in his text-book "Thoracic Diseases" (1961) does not attempt to state an incidence but says, "delayed resolution of pneumonia is usually caused by secondary factors", and refers to Gleichman's work on this point which is discussed below.

Writers who have attempted to define the frequency of organisation of pneumonic consolidation include Milne (1911), Floyd (1922), Symmers and Hoffman (1923), Lord (1928), Lauche (1928), Gleichman and others (1949) and Auerbach and others (1952). Their findings are summarised in Table 8. From the pathological studies which included pneumonias of both lobar and bronchial types the frequency appears to be between 1 and 12 per cent (average 6.02 per cent). The figure of 26.2 per cent delayed resolution in the clinical study of Gleichman and others is probably misleadingly high. There /

There is little doubt that some of their patients would have shown resolution of their pneumonia with observation beyond the thirty day period they arbitrarily introduced, and, moreover, many patients were referred specifically to their unit for investigation and treatment of "pneumonia with delayed resolution". Although Floyd (1922) comments that "organising pneumonia is not a rare disease at autopsy", Kidd, in the Lumlein lectures for 1912, states that for pneumonia to terminate in fibrosis is a "rare sequence of events". Perhaps this can be explained by the fact that in the pre-chemotherapeutic era a high proportion of the deaths occurred early in the disease. Pickhardt (1928) also states that "unresolved pneumonia is comparatively rare".

Some papers have suggested that the frequency of organising pneumonia may be increasing. Symmers and Hoffman (1923) based their figure of 3.2 per cent on necropsies performed prior to 1923. In the first four months of 1923 they found the incidence was 20.6 per cent but manifestly little stress can be laid on this truncated observation. The figure of 12 per cent found by Auerbach and others was calculated from necropsies performed between 1940 and 1950. In a retrospective study they found 7 per cent in the years 1930 /

1930 to 1940 and 5 per cent from 1920 to 1930. Arisi and Schamaun (1962) also state their belief that this condition is becoming more frequent. Naturally, comment has been made concerning the possible explanation for this apparent increase but reference will be made to this in the discussion on pathogenesis.

From what has been written, it is obviously difficult to be precise with regard to the incidence of organising pneumonia but it is probably reasonable to state that roughly 1 in 20 of all people who develop pneumonia fail to achieve complete resolution of their lesion.

DOES ORGANISING PNEUMONIA HAVE A
CHARACTERISTIC CLINICAL PICTURE ?

It has been implied that organising pneumonia with or without suppuration can be diagnosed only in retrospect and by prolonged radiological observation. Are there no features, however, which might enable the clinician to suspect the sequence of events as they occur?

Perhaps the first point of interest with regard to the clinical features is the age and sex incidence (Fig. 1). Fifty consecutive cases of pneumonia without organisation admitted to the same unit were analysed with regard to age and sex. There were twenty-nine men and twenty-one women - a ratio of 1.4:1 instead of 4:1 - and an age incidence of thirty-eight per cent males in the fifty to seventy year old group instead of seventy-five per cent. It is stated that pneumococcal pneumonia is commoner in males than in females (Scadding in "Diseases of the Chest", edited by Marshall and Perry 1952) and that in most hospital statistics there are two to three times as many. This figure may be misleadingly high as a higher proportion of male patients with pneumonia are treated in hospital. Indeed, in Oswald, Simon and Shooter's (1961) study of patients admitted to hospital /

hospital with "clinical pneumonia" the ratio of males to females was 1.8 to 1. Scadding also states that the incidence of pneumonia of all forms is somewhat greater at the extremes of life, and there is support for the view that organising pneumonia is commonest in the middle-aged male. The authors who report series of twenty or more patients (Nicholson 1950; Erasmus 1954; De Janney and Bigman 1959; and Arisi and Schamaun 1962) report male:female ratios varying 3.5:1 to 12:1. In most instances the fifty to seventy age group is predominantly affected.

The seasonal incidence (Fig. 2) merely shows what might be expected, that respiratory infections are more common in the winter months.

In themselves, the initial symptoms and physical findings are unhelpful in that they merely suggest the presence of a respiratory infection. Four features (Fig. 3) may be worthy of note as they are perhaps not so commonly seen with ordinary pneumonias. Firstly, there is the relatively high proportion of patients who experience an insidious onset to their disease. This is mentioned by Kershner and Adams (1948) and Waddell and others (1949). Secondly, the triad of /

of haemoptysis, weight loss and finger clubbing, although seen in a minority of these cases, is mentioned by several authors and is of obvious importance from the point of view of differential diagnosis. When these features are present a diagnosis of bronchiectasis, or more particularly, bronchial carcinoma, may be made and this diagnostic difficulty which has received specific attention in the literature will be discussed later. There is, then, no clinical picture characteristic of organising or suppurative pneumonia; even recurrent or persisting symptoms usually suggest the more serious diseases already mentioned. Arisi and Schamaun (1962) state that the symptoms in order of frequency are cough, sputum - which is rarely blood-stained - pyrexia, thoracic pain, asthenia, loss of weight, malaise and dyspnoea (c.f. Fig. 3). Nicholson (1950) comments that haemoptysis occurs "quite often" and that finger clubbing is present "in a high proportion".

Reference will be made, in the section dealing with pathogenesis, to the possible role of previous or associated respiratory disease in the production of organising pneumonia. Other respiratory diseases were present in the majority of these patients (Table 2) and indeed about fifty per cent had chronic bronchitis. Robbins and Sniffen (1949) in describing /

describing eleven cases of chronic pneumonitis of the cholesterol type state that there was no co-existing lung disease. De Janney and Bigman (1959), on the other hand, found that one third of their patients gave a history of previous major respiratory infection. This particular point may be seen in perspective, in the light of Oswald and others (1961) finding that 476 out of 1,330 patients admitted to hospital with pneumonia had pre-existing associated respiratory disease.

Evidently, organising pneumonia cannot be diagnosed on the basis of a characteristic clinical picture. The condition may be suspected if symptoms and signs indicate respiratory infection in a middle-aged man who has chronic bronchitis and who may have weight loss, haemoptysis and finger clubbing. It can be established only by investigations to exclude the obvious differential diagnosis - bronchial carcinoma - and by prolonged observation or resection of the lesion.

LABORATORY AND ANCILLARY INVESTIGATIONS.

It is unlikely that laboratory investigations will be of value to the clinician in the diagnosis of this condition. The W.C.C. and E.S.R. are inconstantly raised. Balitskaia (1960) investigated this very point in seventy-four patients with chronic pneumonia, lung abscess or bronchiectasis by repeated examinations of peripheral blood and bone marrow but came to no important conclusions, the changes being those known to occur with any acute or chronic bacterial infection. Similarly, Di Carlo (1957) investigated protein electrophoretic patterns specifically in chronic lung abscess and found reversal of the normal albumen; globulin ratio, with a constant rise in the gamma globulin and an inconstant rise in the alpha and beta globulins. This is commonly found in a variety of chronic infections, e.g., tuberculosis (Boyd and others 1959) and is not sufficiently specific to be of any value in the diagnosis of these cases.

Bacteriology of Sputum.

Bacteriological examination of the sputum is of value in a somewhat negative sense in that tuberculosis is excluded as a cause of the persistent symptoms and radiological opacity. It is unusual to obtain a growth of organisms such as /

as *Klebsiella pneumoniae* (Friedländer's bacillus) or *Staphylococcus aureus*, infection with which is more likely to result in abscess formation. While such organisms may be important factors in a few cases, Logan and Nicholson (1949) state their view that this condition is distinct from specific pneumonias with cavitation. The essentially "mixed" bacterial flora grown from the sputum of these cases is mentioned by Scadding (1936, 1938); Kershner and Adams (1948); Waddell and others (1949); Robbins and Sniffen (1949); Nicholson (1950); Erasmus (1954) and Arisi and Schamaun (1962). It is nowadays unusual to find a patient admitted to hospital with a respiratory infection who has not had some anti-bacterial agent at home. This is a possible explanation for the above findings and for the fact that Oswald and others (1961) found "no pathogens" in approximately fifty per cent of patients admitted to hospital with pneumonia.

Bronchoscopy.

Bronchoscopy is also of value in a negative way. This was undertaken in all cases to exclude the presence of bronchial obstruction particularly by carcinoma, and was negative in this respect in all instances. A few cases showed the /

the presence of pus within the appropriate bronchus and some reddening and swelling of the mucosa at the orifice. Other authors confirm the essentially negative findings at bronchoscopy.

Radiography.

In pure pneumococcal pneumonia, consolidation involves one or both lower lobes in about two thirds of instances, limited upper lobe involvement occurring in about ten per cent (Rubin 1961). In these cases the anatomical distribution is different, the upper lobes being involved in over half the cases (Table 4) with the right upper lobe being the most commonly affected lobe. Moreover, the right lung is affected twice as commonly as the left. The peculiar predilection of this disease for the right upper lobe is mentioned particularly by Kirby and others (1957) but also by Waddell and others (1949); Erasmus (1954) - sixty-nine per cent of his cases - and Arisi and Schamaun (1962). The reason for this is not immediately obvious but it may be, as Kirby and his colleagues suggest, that peculiarities of vascular supply and lymphatic drainage of the right upper lobe predispose the patient with chronic infection to abnormal healing. Certainly it was noted by Mitchell (1955) that cases of pulmonary tuberculosis in the pre-chemotherapy era had a less favourable response in the right /

right compared with the left upper lobe. Probably a likelier explanation is the aspiration of the infected material from the upper respiratory tract, a point which will be discussed more fully in the section on pathogenesis. In this matter a parallel can be drawn to the pathogenesis of inhalational lung abscess which occurs most commonly in the right upper lobe (Brock and others 1942). Brock showed experimentally how the anatomical configuration of the bronchi and posture were responsible for the localisation of the abscesses. This is further borne out by the observations of Picker and Ruoff (1959), in a study of seventy cases of pulmonary abscess, who found the right upper lobe affected in 32.9 per cent.

Apart from the distribution there is little else to distinguish these cases radiologically from ordinary pneumonia but two points might be mentioned briefly. In fifteen instances consolidation was associated with atelectasis and in eight cavitation was demonstrated by tomography, which if it had been carried out in all cases would no doubt have shown cavitation more frequently. Tomography should probably be used more often in this type of lesion.

Bronchography /

Bronchography is not a procedure likely to help with the diagnosis, certainly in the early stages of the disease. Later, it may demonstrate bronchial abnormalities which presumably reflect the degree of permanent broncho-pulmonary damage. It is impossible to be sure that these changes were not present before the pneumonia but it seems on the clinical grounds unlikely. Only two patients had clinical evidence of bronchiectasis. This view is supported by the findings of other authors. Kershner and Adams (1948) performed bronchograms in some of their cases and demonstrated blunting of bronchi but no bronchiectasis. Nicholson (1950) states that when bronchograms are done in the stage of fibrosis they show distortion of the bronchial tree and bronchiectasis. Erasmus (1954) comments, "In most cases with cavitation healing was accompanied by development of bronchial distortion or bronchiectasis".

PATIENTS THOUGHT TO HAVE BRONCHIAL CARCINOMA

It may be appropriate to discuss at this point those patients who were thought to have bronchial carcinoma and who were submitted to thoracotomy. (The three patients who had pulmonary resection carried out because of persistence of symptoms will be discussed in the section dealing with treatment.) All four patients (Cases 40, 41, 45 and 48) were men between the ages of fifty-two and sixty-eight years, and all had symptoms and radiological appearances strongly suggestive of carcinoma. This problem in differential diagnosis is stressed by a number of authors. All or most of the patients described by Freedlander and Wolpaw (1940); Brewar and others (1948); Robbins and Sniffen (1949); Desai and Leroux (1953); Malm (1954); Kirby and others (1957); Sandborn (1958); Brunner and Tanner (1959); Kusagawa and others (1959); Sullivan (1961); and Arisi and Schamaun (1962) were thought to have carcinoma and accordingly submitted to thoracotomy. The clinician's difficulties when faced with a clinical picture and radiological appearance such as have been described, albeit with a "negative" bronchoscopic examination, are formidable. He is fully justified in submitting several cases of chronic inflammatory disease to operation in the hope of being able to resect one /

one carcinoma - indeed, it is the only course open to him. Sanborn (1958) suggests that it is unwise to postpone thoracotomy more than eight weeks in a thirty-five to forty year old man with unresolved pneumonia. Even then, however, difficulties persist. Freedlander and Wolpaw (1940) stress that it is often impossible to differentiate clearly between malignancy and non-malignancy even by direct inspection and palpation of the lung. The result of frozen sections must also be acted upon with circumspection as, of course, suppuration, fibrosis and cholesterol pneumonia may co-exist with carcinoma.

THE TREATMENT OF ORGANISING PNEUMONIA

If it is accepted that organisation is the end result of bacterial infection (albeit modified by a number of factors) then the administration of antibiotics in the early phase of the illness would seem a reasonable step. In the presence of systemic evidence of infection such as fever, or local evidence such as the expectoration of purulent sputum, antibiotics are obviously indicated. The indications for antibiotics are less clear, however, in those cases where there is little or no systemic upset and where sputum is minimal and contains only a small amount of pus. Nevertheless, most clinicians faced with a radiographic pulmonary opacity of presumably inflammatory origin would give antibiotics. Whether this course of action alters the progress of the disease is open to doubt, although the belief that it would is implied in the prolonged courses of antibiotics given to some of these patients. As has been shown, however, several patients who for various reasons were given relatively short courses of antibiotics continued to show clearing of their opacities for six months or more after the treatment was stopped.

The choice of antibiotic in a disease in which there is clearly /

clearly a variety of infecting organisms is difficult. Where a pure growth of a single organism is obtained, the sensitivity tests carried out by the bacteriologist are certainly valuable and the most appropriate antibiotic for the circumstances can usually be given. In the majority of cases, where the bacteriologist can only report a growth of mixed upper respiratory tract organisms, the efficacy of penicillin used alone may be questioned. Furthermore, the frequency with which sulphonamides and antibiotics had been used before admission to hospital makes the suggestion that the organisms present were resistant to the more commonly used chemotherapeutic agents, a valid one. Perhaps the most logical approach in the absence of bacteriological guidance is to use one of the broad spectrum antibiotics. In this context one of the newer penicillins, ampicillin, may be effective as it is useful in treating infective exacerbations of chronic bronchitis (Ayliffe and Pride 1962) and is highly effective against *H.influenzae* (Barber and Waterworth 1962).

Information from the literature concerning the effect of antibiotics on this type of disease is scanty. This may be explained by the fact that many patients are submitted to immediate thoracotomy and pulmonary resection in the belief that they have carcinoma. In addition, several authors were writing /

writing at the beginning of the antibiotic era when doses were small by present standards and when the range of drugs was limited. Nicholson (1950), in describing "chronic non-specific suppurative pneumonia", was reporting cases with more florid features of suppuration than those described here but nevertheless with pathological features common to both groups. His patients were seen in a Military Hospital from 1941 to 1945 and at the Brompton Hospital from 1946 to 1948. Those in the Military Hospital were treated with postural drainage and sulphonamides (some had penicillin in small doses) and on the whole responded poorly. Those in the Brompton Hospital received larger doses of penicillin (1 mega unit daily) and did better, the difference being thought to be due to penicillin. Eventually most of these patients had pulmonary resection. His experience forced Nicholson to the conclusion that resection was the only measure likely to restore the patient to health and to stop the progression of the disease. Perhaps this view would have been modified had modern antibiotics been available at that time. In discussing chronic pulmonary suppuration Scuro (1955) states that antibiotic therapy, especially when given locally by bronchoscopic technique, is very good pre-operative treatment but admits that these drugs given early may limit suppuration to an insignificant amount. Kirby and others /

others (1957) reporting twenty-three patients in whom delayed resolution and partial collapse in the right upper lobe had followed bacterial pneumonia considered that the clinical course did not appear to be altered by addition of antibiotics. Although they were discussing lung abscess it is of interest to note Wolcott and Murphy's (1957) assessment of surgical and conservative management. They divided their cases into three groups: (1) those from 1941-1944, which they called the sulphonamide period; (2) from 1944-1952, the penicillin period; and (3) 1952-1956, the antibiotic or tryptar period - and showed that the mortality had fallen progressively from 31.5 per cent in the first group to 17.2 per cent in the third. In 1959 De Janney and Bigman stated that their policy with regard to the treatment of chronic pulmonary suppuration was "prolonged chemotherapy".

The necessity for immediate thoracotomy and pulmonary resection in the case where bronchial carcinoma cannot be excluded, is obvious. Apart from these instances, resection had to be undertaken in the present series on only three occasions, when symptoms which were mainly cough, purulent sputum and vague ill-health, had persisted despite antibiotic therapy. (It might be argued that Case 35 D.U. should have been similarly treated.) Details of these cases are /

are given in Table 9. No opinion can be expressed as to why symptoms persisted in these cases although each had some evidence of bronchopulmonary suppuration. Authors of a decade or more ago stress the importance of surgical treatment in pulmonary suppuration. Taber and Ehrenhaft (1953) wrote that excisional surgery constitutes the treatment of choice and Nicholson's views have already been mentioned. Kershner and Adams (1948) treated nine of their ten cases by surgical means although medical measures included sulphonamides in their more recent cases only. Writing of pulmonary abscess in 1959, Pickar and Ruoff concede that medical therapy should be continued if improvement is demonstrated. Arisi and Schamaun (1962) indicate two reasons (apart from suspicion of carcinoma) for surgical treatment: (1) suppuration associated with severe cachexia; and (2) failure to improve after six to eight weeks of adequate conservative treatment. Similar views are held by Meszaros (1960). If "failure to improve" refers to the patient's symptoms and general clinical condition and not necessarily to the radiological opacity, I should agree with this, but stress that this should be necessary in only a small proportion of patients.

Forms of treatment other than those already mentioned
have /

have never been seriously entertained. In 1916, however, Quimby and Quimby reported twelve cases of unresolved pneumonia successfully treated with X-rays. They comment - "No pathological process in the body responds quicker to an X-ray exposure than the non-resolution following pneumonia. The action seems to be a specific one." No confirmation of this view has ever appeared. More recently an interesting adjunct to antibiotic therapy has been suggested by Hankiss and Keszthelyi (1960). They report that in animals histamine may potentiate the effect of streptomycin in tuberculosis presumably through stimulation of the reticulo-endothelial system and increased diffusability in the tissues. To nine patients with chronic non-specific pneumonia of two months duration who had had previously adequate doses of antibiotics without marked benefit, they gave three to four subcutaneous injections (0.2 - 0.4 mg.) of histamine per day for two to three weeks with the addition of antibiotic given half an hour after histamine. Results in all cases are described as "excellent". This work may merit further investigation.

Since the formation of fibrous tissue plays such an important part in the pathology of these cases, it is surprising /

surprising that no attempt has been made to limit this by the use of corticosteroid drugs. These drugs are now accepted in the treatment of such conditions as Hamman-Rich syndrome and sarcoidosis, both of which may result in severe pulmonary fibrosis. They have also an acknowledged place in the treatment of pulmonary tuberculosis provided adequate chemotherapy is also given. The fear that corticosteroids may cause extension of a bacterial infection is a real one especially since it is difficult to be sure, as in these cases, that the appropriate antibiotic is being given. In this context, then, I think it would be of interest to record two cases seen after this study was made, one at the Western General Hospital, Edinburgh, and the other at Stobhill General Hospital, Glasgow.

Case I.

<u>Name</u>	<u>Age</u>	<u>Occupation</u>
W.K.	57	Flourmill Worker

He was admitted to hospital in March 1961 with a four day history of breathlessness and right sided mild pleuritic chest pain, which had been of sudden onset. He had only slight unproductive cough and his only other admitted symptom was anorexia. He had suffered from intermittent bronchitis for twelve years.

On /

On admission he had a temperature of 99.8°F . and continued to have a low-grade fever for five days. The percussion note was impaired and there were medium crepitations heard over the right lower axilla. There was no finger clubbing and the other systems were clinically normal. The W.C.C. was 8,400/c.mm. and E.S.R. 82 mm. in one hour, falling to 38 mm. in one hour before his discharge. No sputum was available for bacteriological examination. Bronchoscopy showed no abnormality. A chest radiograph showed consolidation in the right middle lobe (Fig. 20a).

He was treated with penicillin 2 mega units daily and streptomycin 1G. daily by intramuscular injection from 14/3/61 for ten days. He then received demethylchlortetracycline 1.2G. daily by mouth for a further three weeks. From 27/3/61 for a period of ten days he also received prednisolone 20 mg. daily by mouth. The failure to resolve while on antibiotics and the apparent response to prednisolone are shown in Fig. 20a to 20e.

Case II. /

Case II.

<u>Name</u>	<u>Age</u>	<u>Occupation</u>
R.S.	66	Engineer

This patient had had mild chronic bronchitis for many years, and was admitted to hospital in April 1962. He had complained of vague ill-health for three weeks and slightly increased cough and purulent sputum for three days. On the day before admission he developed lumbar pain, vomiting, diarrhoea and fever.

When first seen he was moderately ill, febrile and had typical clinical signs of pneumonic consolidation in the right upper lobe. There was no finger clubbing. W.C.C. was 12,000/c.mm. E.S.R. 106 mm. in one hour falling to 21 mm. in one hour before his discharge. Sputum, which was muco-purulent, gave a mixed growth of upper respiratory tract organisms with a few colonies of *B. proteus*. Bronchoscopy revealed no abnormality other than reddening of the mucosa at the orifice of the right upper lobe bronchus and thin pus appearing from within the right upper lobe. Chest radiograph showed consolidation of right upper lobe (Fig. 21a).

Treatment with penicillin 2 mega units daily intramuscularly was started and continued for over two weeks. Ampicillin was /

was then given by mouth for a further two weeks, streptomycin subsequently for a week and ampicillin again for about six weeks. (For details see Fig. 21a to 21f.) Prednisolone was given a month after the start of antibiotic therapy initially in a dose of 60 mg. daily but with rapid reduction to a maintenance dose and continued except for a short break for two and a half months. Fig. 21a to 21f show only slight to moderate clearing during the month on antibiotics alone but more rapid improvement following the administration of prednisolone.

I have little doubt that these two cases are of the same type as have been described in this series of fifty. It is probable that the rate of radiological clearing accelerated after the administration of prednisolone but whether this is a true relationship or mere chance is difficult to say. Such cases are not common and a controlled trial is virtually impossible for the individual clinician to conduct. Nevertheless, I believe that corticosteroid drugs may accelerate resolution and prevent gross fibrosis, although they should always be given with antibiotic cover.

It /



It may be possible to summarise these remarks on the treatment of organising pneumonia by saying that antibiotics are indicated in the presence of systemic or local evidence of infection but that they are of unproven value otherwise; that surgical resection of the diseased lung should be carried out when cough, purulent sputum and general ill-health persist despite antibiotic treatment for longer than eight to ten weeks; and that corticosteroid drugs may be useful in accelerating resolution and preventing fibrosis.

THE PATHOLOGY AND PATHOGENESIS OF ORGANISING PNEUMONIA

It has already been stated that cases similar to those described here have been accorded a variety of different labels. How close the similarity is may be arguable and indeed some authors deny the inter-relationship of such pathological features as organisation of alveolar exudate, interstitial pneumonia and "cholesterol pneumonitis". Chiari (1951), for example, considered that it ought to be possible to establish a particular noxious agent, in analogy to other forms of pneumonia such as virus pneumonia, when he described his cases of "chronic suppurative foam-cell pneumonia". Again, it was emphasised by Brewar and others (1948) that the cases of chronic pneumonitis which they described were not cases of "so-called unresolved pneumonia". Nevertheless, there is no doubt that the abovementioned features can co-exist in the same lung (Case 10), and this is admitted by even the most emphatic of the protagonists of the separate disease theory. Their admission, however, is qualified by attempts to explain the appearances on the basis of differing pathogenesis. Waddell and others (1949) state - "Organisation of the intra-alveolar exudate did not take place in this chronic pneumonitis in the absence of a superimposed acute pneumonitis." A re-statement of the pathological /

pathological changes found in this series and a comment on their possible significance would I think be appropriate at this point. These included:

1) Pneumonia with intra-alveolar exudation of fibrin and neutrophil polymorph leucocytes. These changes are, of course, typical of bacterial infection in the later stages of grey hepatisation, resolution or organisation. Involvement of interstitial tissue and alveolar walls is not a feature. The organism responsible is commonly the pneumococcus but may be the staphylococcus, streptococcus, Friedländer's bacillus or H.influenzae.

2) Interstitial pneumonia or pneumonitis characterised by peribronchial and alveolar wall infiltration with lymphocytes and respiratory epithelial proliferation. These distinctive features may occur in infection with the viruses of influenza, ornithosis, measles and atypical virus pneumonia and also with rickettsial infections. Although Gross (1960) stresses the vastly different aetiological backgrounds of chronic interstitial pneumonitis, I think we can exclude from our discussion such things as pneumoconiosis, tuberculosis, sarcoidosis and Hamman-Rich disease.

3) /

3) Areas of lipid containing macrophages lying within alveoli. This phenomenon has been described in association with non-specific suppuration and bronchial obstruction but it is also found in a disease of unknown aetiology called "chronic pneumonitis of cholesterol type".

4) Suppuration again may occur in association with bronchial obstruction but also after inhalation of infected material and with certain specific pneumonias.

5) Fibrosis, the end result of a variety of insults - infective, chemical and physical - to lung tissue and which could result from any of the processes described above.

From the information presented so far it seems unlikely that any single factor was operating in these cases. The histological picture and the clinical features of most of them suggests that infection played an important initiating part, and that virus infection was not uncommon.

Spencer /

Spencer (1962) describes the distinctive interstitial pneumonitis of virus infection but makes the following observation: "The majority of the proved or suspected virus infections of the lung predispose the respiratory tract to secondary bacterial infection and when this occurs the distinctive viral qualities of the pulmonary inflammation are lost." It is my contention that many of the clinical and pathological features of these cases can be explained on the basis of combined virus and bacterial infection, although to prove the presence of virus infection would require antibody studies which have not been carried out. Broncho-pulmonary tissue already damaged by virus would be readily infected by the normal upper respiratory tract flora, in a way analogous to the so-called aspiration pneumonias, which may explain the predominance of non-specific organisms in these cases. It might be argued that a very high E.S.R. lends support to the contention that a particular pneumonia is viral in origin, a suggestion which has been made by Galbraith and Jones (1958). Only a small number of patients in this series had very high E.S.R. but many were first seen relatively late in the course of their disease.

Although the concept of virus and/or bacterial
infection /

infection is easy to accept, the reasons why there is progress to the other changes of suppuration, fibrosis and "cholesterol pneumonitis" are difficult to elucidate. It would, perhaps, be reasonable to take these points in turn and discuss the possible reasons for them.

1) Suppuration. This, of course, may result from many varieties of bacterial pneumonia but particularly those due to *Staphylococcus aureus* and *Klebsiella pneumoniae* (Friedländer's bacillus). Only six of the fifty cases in this series had either of these organisms in their sputum and all authors discussing this "non-specific" suppuration (e.g., Scadding 1936; Nicholson 1950; and Erasmus 1954) stress that mixed growths of organisms are almost invariably grown. Moreover, the other important factor in the production of pulmonary suppuration - viz., bronchial obstruction - was not present in these cases nor in other series. To what, then, can we ascribe the suppurative changes? De Janney and Bigman (1959) emphasise that "the usual causes of suppuration" are absent but mention that eight of their patients were chronic alcoholics, three were epileptics and two had diabetes mellitus; one third had previous major respiratory infection.

Erasmus /

Erasmus (1954) in discussing suppurative pneumonia in the Bantu stresses the importance of gingival and dental sepsis - eighty-three per cent in his series, as opposed to eighteen per cent in non-suppurative pneumonia - and accepts the situation of the primary pulmonary lesion as support for his hypothesis of aspiration of infected material from the mouth and upper respiratory tract. Pulmonary infarction has long been known to provide conditions suitable for suppuration to occur. The incidence has been variously reported as 0.6 per cent (Murray and McKenzie 1942) to 4.9 per cent (Chester and Krause 1942) of cases coming to necropsy. The type of suppuration occurring, however, is most commonly acute, resulting in lung abscess as reported by Davison (1958). Peräsol and Railo (1954) quote Haller as stating that there has been an obvious shift in favour of post-pneumonic developments in the aetiology of lung abscess chiefly through the influence of the new drugs (sulphonamides and penicillin): treatment may remove the infection but leucocyte infiltration and rapid resorption of the fibrinous exudate may be inhibited. Antibiotics have also been incriminated as a possible contributing factor in the production of organisation and this problem will be discussed later.

It /

It is, unfortunately, impossible to lay the blame for the suppuration seen in these cases squarely on the above mentioned factors. All that can be said is that a variety of bacteria, none of them in themselves particularly virulent, may under certain conditions, which have been discussed above, produce suppuration. This concept of the importance of the host reaction, or resistance of the patient, is, of course, no new one and was mentioned by Scadding in 1936.

2) Fibrosis. The causes of pulmonary fibrosis are very numerous. Its occurrence as a sequel to bacterial pneumonia is accepted and it may also occur after the interstitial pneumonia of virus infection. Spencer (1962) states that in the stage of recovery from atypical pneumonia the more seriously damaged alveoli became fibrosed and later lined by cubical epithelium which often undergoes stratification. Discussing influenzal pneumonia, however, he says - "The late sequelae of influenzal virus infections very largely depend upon the presence or absence of secondary bacterial infection, but in pure virus infections there may be little or no residual damage."

At the turn of the century, clinicians (such as, Clark, Hadley and Chaplin 1894) put forward such conditions as prolonged chronic bronchitis, collapse of the lung, alcoholism and syphilis as possible causes of fibrosis after infection.

Milne /

Milne listed wasted individuals, measles, alcohol, syphilis, pleural adhesions and emphysema but added that in spite of the "great prevalence of syphilis" (U.S.A. 1911!), lung lesions are comparatively rare. Piersol, writing in 1922, was of the opinion that unresolved pneumonia is noticeably frequent after influenza epidemics and states that after the epidemics of influenza in 1889 - 1890 there was a decided increase in the incidence of chronic non-tuberculous lung infection. Otherwise, he confined himself to commenting that it was more apt to occur in children, old people and debilitated people. Early experimental work of some interest was reviewed by Kline (1917). He refers to work carried out by Flexner (1903), Opie (1905) and himself and Winternitz (1915) which suggested that the autolysis of leucocytes and the digestion of fibrin are inhibited by the presence of serum and that normally little or no serum reaches the exudate in the alveoli in the stage of grey hepatisation as the circulation through the consolidated portion of lung is very poor. It is suggested, therefore, that the presence of serum does not allow complete resolution of pneumonic consolidation.

More recently, Amberson (1943) thought that unresolved, organised or protracted pneumonia might be caused by (among other /

other things) previous damage to pulmonary parenchyma; fibrotic and emphysematous lung, he contended, was lacking in "functional efficiency" with regard to blood supply, lymph supply and ventilation. Gleichman and others (1949) studied 198 cases of pneumonia with delayed resolution and concluded that one of the major aetiological processes was impaired bronchial drainage caused by chronic bronchitis, asthma, emphysema and pulmonary fibrosis - conditions which taken together were more than twice as common causes as carcinoma. Other important factors were the aspiration of anaerobes from the oro-pharynx and the presence of suppuration. MacQuigg (1956) also considers the bronchial factor an important one and has advanced the theory that non-specific pneumonitis commences as a "localised chronic bronchitis" with subsequent development of bronchiolar metaplasia and fibrosis. The significance of virus infection is again mentioned by Auerbach and others (1952) who also make the suggestion that anti-bacterial agents (particularly antibiotics) may alter the natural host response through an effect on the organism. Exudates rich in fibrin and poor in leucocytes (and enzymes derived therefrom) are more apt to organise. In their material they noted a paucity of polymorphs, the predominant cell being the monocyte. The possible adverse effect of /

of antibacterial agents has been suggested by other authors (Haller, quoted by Peräsol and Railo 1954, and Arisi and Schamaun 1962), but good evidence for this view is lacking. It seems reasonable to assume that the rapid control of bacteria by antibiotics would, at the same time, limit full antibody response. Beyond this it is impossible to go at the present but it may be relevant to quote Florey (1958) in this context - "Both common sense and some experimental evidence suggest that increased humoral defences plus an antibacterial drug would be more effective in overcoming an infection than the drug alone".

The entire concept of organising pneumonia has, however, been queried by Gross and Benz (1961) in a study of the histopathological changes in the lungs in twenty-nine cases in which this condition has been diagnosed. They found that the outstanding feature in each of their cases was that the alveolar walls were generally moderately to severely thickened by non-collagenous reticulin tissue which in some cases extended from the alveolar walls into air spaces so as to fill them except for a peripheral cleft. These fibres showed evidence of degeneration (fragmentation, condensation and lysis) rather than of new fibre formation. They /

They conclude that all the patients suffered from what they call an accretive chronic interstitial pneumonitis in which there was a potential re-establishment of air spaces by a degenerative and necrotising process affecting primarily the occluding intra-alveolar tissue. The corollary to this is that there is no organisation in these cases of "organising" pneumonia. This is a novel concept but does little to influence the accepted facts of non-resolution, invasion by fibroblasts and eventual conversion to fibrous tissue, of an intra-alveolar inflammatory exudate.

The evidence for the operation of any of the above factors in this series of cases is at best circumstantial. Certainly the majority had had previous respiratory disease (Table 2) and almost fifty per cent were chronic bronchitics. It is conceded that a high proportion of patients who develop pneumonia give a history of previous respiratory disease: Oswald and others (1961) reviewing 1330 cases of "clinical pneumonia" admitted to St. Bartholomew's Hospital, London, during the years 1949 to 1958 found that thirty-five per cent had previous or associated respiratory disease, the most common being chronic bronchitis and emphysema. Nevertheless, the proportion in these cases seems /

seems remarkably high. Again, although there was no bronchial occlusion there may have been some functional impairment of bronchial drainage. Reddening and swelling of bronchial mucosa were seen in a few cases, bronchial abnormalities were seen on bronchograms and there was contraction of the lobe or segment in a proportion; in the resected specimens thickening of bronchial walls was seen. It is however only possible to suggest a reason or combination of reasons for the presence of fibrosis in this series.

3) "Cholesterol Pneumonia". This is perhaps the most difficult change to account for and the most controversial. It should be stressed at the outset that we are not dealing here with the pulmonary reaction to lipid material of exogenous origin, such as liquid paraffin. Hewlett and others (1961) have reviewed this condition and have suggested that microscopic examination can differentiate endogenous and exogenous lipid pneumonia. The histological picture of exogenous lipid pneumonia, can however be modified considerably by secondary bacterial invasion with typical inflammatory response and even cavitation. All types of lipid pneumonia are reviewed by MacDonald and Hodgson (1954).

Small /

Small localised areas of endogenous lipid pneumonia are known to occur in association with bronchiectasis, pulmonary abscess, tuberculosis and carcinoma (Editorial; Brit. med. J., 1961). It is also a major feature in lung tissue distal to bronchial obstruction in what Spencer (1962) refers to as "obstructive pneumonitis" and finally it has been described by some authors (Waddell and others 1949; Robbins and Sniffen 1949; Chiari 1951; and Sullivan and others 1961) as a separate disease entity of unknown aetiology which has been called "chronic pneumonitis of cholesterol type".

Three attempts have been made to investigate this problem experimentally. Gross and others (1952) found they could produce a lipid pneumonia in rats by the inhalational administration of antimony trioxide. The pulmonary fibrosis which appeared was due, they considered, to the lipid material and not to antimony trioxide, which was also present in lymph nodes from which lipids and fibrosis were absent. Pathological lesions closely resembling endogenous lipid pneumonia described in human beings were produced in rabbits by Waddell and others (1954) by the administration of *Klebsiella pneumoniae* and *Pasteurella pseudotuberculosis* in the presence of high blood lipid levels. In the presence of normal blood lipid levels /

levels, fat and cholesterol also appeared in small amounts in chronically inflamed areas. They found similar phenomena in ischaemic muscle suggesting that the process was dependent on local physico-chemical conditions. They postulate that local acidosis developing in an injured or infected tissue has an adverse effect on colloid lipids. The nature of the material appears to be cholesterol, cholesterol esters, lecithin and fatty acids. Claggett and MacDonald (1945) found 4.1 per cent of the wet weight of affected lung to be due to these. Finally, Maggi and others (1959) were able to produce the disease in rabbits by a variety of agents in the presence of high cholesterolaemia induced by intravenous injection of Triton W.R.-1339.

One of the difficulties of explaining the occurrence of lipid pneumonia in these and similar cases is the absence of bronchial occlusion and the unlikelihood that it is part of an "obstructive pneumonitis". One might wonder, however, whether impaired bronchial drainage, for the reasons mentioned previously, might play a part. Chiari (1951) is of the opinion that the accumulation of lipid material is due to a disturbance of lymphatic flow from the affected lung area - that there is in fact a chronic /

chronic lymphatic obstruction. This theory may be worthy of consideration when one considers the location of lymphatics around bronchi and the fact that many of the cases of "interstitial pneumonitis" perhaps of virus aetiology showed marked peribronchial involvement. This view is also held by Belli and others (1959) who describe pneumonitis of the cholesterol type in association with silicosis and lymphangitic carcinomatosis of the lungs in which the accumulation of lipids was, in their opinion, due to blockage of the lymphatic vessels. An interesting suggestion is made by Fienberg (1953) who makes a comparison of the histological changes occurring in necrotising granulomatosis and angitis of the lungs and in chronic pneumonitis of the cholesterol type and finds them very similar. He says - "The hypothesis is offered that the primary disorder in pneumonitis of the cholesterol type is the ulceration and obstruction of the smaller branches of the bronchial tree, which bring about the appearance of the intra-alveolar macrophages filled with cholesterol-rich lipid, the latter being a secondary phenomenon. Furthermore, it is suggested that these changes in the smaller branches of the bronchial tree are caused by a hypersensitivity phenomenon, similar, but of lower intensity, to that responsible for like changes in /

in both idiopneumonic and disseminated necrotising granulomatosis and angiitis, and that this represents an Arthus reaction localised in the bronchial tree. The cause of the sensitisation is unknown."

The suggestions have also been made that lipoid pneumonia may arise from irradiation of the lungs (De Navesquez and others 1951) and large incomplete pulmonary infarcts (Waddell and others 1949). These seem unlikely in the absence of confirmatory reports on conditions which are well known and whose pathology has been extensively studied.

It is apparent, then, that cholesterol pneumonia may occur in a variety of circumstances. It may occur in infected or otherwise damaged lung tissue where some local physico-chemical change has taken place and in the presence of bronchial and lymphatic obstruction. Certainly it seems unnecessary, and indeed unhelpful, to claim cholesterol pneumonia as a separate disease. Several authors including Kershner and Adams (1948), Nicholson (1950) and Arisi and Schamaun (1962) emphasise its co-existence with suppuration and interstitial pneumonitis and fibrosis. Chiari says - "We often came upon patches with every sign of a typical indurative pneumonia or the early stages of such /

such a condition, in which the fibrinous exudates in the alveoli were in the process of organisation", and this comment is noteworthy because it undermines his claim that his foam-cell pneumonia is a distinct entity, notwithstanding his explanation that secondary bacterial infection had occurred.

In a condition where different histological appearances may exist in the same lung it is not surprising that a variety of aetiological processes may be involved and that the interplay of these is complex. I have tried, in Figure 22 to give a schematic outline of what may be the sequence of events. Infection is the starting point with virus infection giving rise to the interstitial pneumonitis forms which may be complicated by bacterial infection. Both infections may cause suppuration in the presence of such factors as previous respiratory disease, dental sepsis and debility, and both may give rise to fibrosis possibly when there is impaired bronchial drainage and in the presence of antibiotics. Suppuration itself may give rise to fibrosis and also predispose to cholesterol pneumonia. This, however, is more likely to be caused by lymphatic obstruction from impaired bronchial drainage. It is easy to see why, if any of these features happens to predominate, the condition acquires one of the many designations discussed in the introduction.

THE PROGNOSIS OF ORGANISING PNEUMONIA

Early writers were uniformly gloomy concerning the outlook for this type of lesion. "All the cases observed by me terminated fatally" (Heitler 1884). "Organising lobar pneumonia once fully established proves fatal in the vast majority of cases" (Floyd 1922). The picture changed completely however when efficient thoracic surgery and later anti-bacterial drugs removed the threat to life. The question then becomes - How much residual damage has been done to bronchopulmonary tissue and what does this imply in terms of the patient's well-being and future susceptibility to respiratory infection?

Sellors and others (1946) acknowledged that permanent damage to the lung is the usual end-result but the ultimate state of the affected lobes or segments was obscure. Exacerbations of acute pneumonitis, abscess formation and bronchiectasis was the course of events envisaged by Waddell and others (1949). Erasmus (1954) wrote that - "All cases recovered completely", but there is no mention of radiological clearing and no mention of any follow-up examinations.

I think a fairly precise statement of prognosis in the light of present day conditions can be made from this study, especially the follow-up examination, and can be summarised by the following points. 1) The mortality is nil. 2) A few patients, because of persistence of symptoms, require pulmonary resection. The vast majority, however, despite permanent fibrosis of lung parenchyma and bronchial distortion in most, have no respiratory symptoms on this account and do not appear to be more liable to infections of the respiratory tract.

SUMMARY AND CONCLUSIONS

The objects of this thesis have been to present these fifty cases as forming a clinical entity, although only after precise statement of the criteria to be used, and to describe the clinical and pathological features. An assessment of the literature has not been easy since a variety of different names have been used to describe essentially similar pathological processes, although the histological appearances are sometimes dissimilar. The reasons for this I have attempted to explain. In my opinion, no useful purpose is served by subdividing cases of this type in this way and the use of the term "Kerschner-Adams syndrome" as used by Desai and Leroux can only be regarded as adding to confusion.

Although it was stated in the introduction that Laennec gave a clinical description of this condition, his knowledge of it was necessarily limited and he regarded it as extremely rare. "Is there really such a disease as chronic peripneumony?", he asks, and answers himself, "The question will only appear singular to those who are unacquainted with pathological anatomy!". Some seventy years later, Heitler knew much more about this and in 1884 gave a most detailed clinical and pathological description to the Imperial-Royal Society of Physicians in Vienna of a condition he thought should be called primary parenchymatous pneumonia. /

pneumonia. In this century it has been the different interpretations put upon the histological appearances that have confused the terminology.

It is impossible to coin a short and entirely descriptive label for these cases. "Organising pneumonia with or without suppuration" is clumsy and makes no mention of the cholesterol pneumonia which may be an important feature of these cases. However, with the suggested pathogenesis in mind, it seems the most reasonable term.

It is possible therefore to summarise this thesis by stating the following points.

- 1) The clinical, radiological, laboratory and pathological features of fifty cases of organising pneumonia are presented.
- 2) It is suggested that the label, "organising pneumonia with or without suppuration", be used in preference to "suppurative pneumonia".
- 3) This condition can be diagnosed clinically only by prolonged radiological observation; in this series, fibrotic changes remaining six months after the onset were found to be permanent.
- 4) /

4) It is a disease predominantly of males in the fifty to seventy age group with chronic bronchitis, and weight loss, haemoptysis and finger clubbing occurring sufficiently frequently to make the differential diagnosis from bronchial carcinoma sometimes a problem.

5) Treatment with antibiotics is of value when there is systemic evidence of infection or when sputum remains purulent but does not appear to influence the rate of clearing of pulmonary radiological opacities to any significant degree. Only a few cases require surgical resection because of persistence of symptoms. A few cases must inevitably be submitted to thoracotomy when the differential diagnosis from bronchial carcinoma cannot be made in any other way.

6) The pathogenesis is complex but is probably virus and/or bacterial pneumonia proceeding, under the influence of a number of imperfectly understood factors, to suppuration, fibrosis and occasionally cholesterol pneumonitis, singly or in combination.

7) With antibiotics and thoracic surgery the mortality of the condition is nil. Despite permanent pulmonary fibrosis and bronchial abnormalities in a majority of cases, most patients suffer no important injury to their general well-being.

TYPE OF LESION	NUMBER OF PATIENTS
Relapsing polyneuritis	3
Extensor polyneuritis	3
Isolated peripheral	1
Acute degenerative polyneuritis (acute long disease)	6
Exacerbations of <u>TABLES</u>	10
occurring at 1 month	2
occurring at 2 months	1
occurring at 3 months	2
occurring at 4 months	3
Chronic degenerative polyneuritis (including peripheral)	20
Original group of "degenerative polyneuritis"	70

Table 11. Final diagnosis in a group of 70 patients with "degenerative polyneuritis".

FINAL DIAGNOSIS	NUMBER OF PATIENTS
Pulmonary tuberculosis.	2
Infected pulmonary cyst.	1
Bronchial carcinoma.	1
Acute suppurative pneumonia (Acute lung abscess).	8
Pneumonia with delayed resolution:	10
clearing at 1 month.	2
clearing at 2 months.	1
clearing at 3 months.	2
clearing at 6 months.	5
Chronic suppurative pneumonia (Organising pneumonia).	50
Original group of "suppurative pneumonias".	72

Table 1: Final diagnosis in a group of 72 patients with "suppurative pneumonia".

None.	14
Chronic bronchitis.	24
Recurrent acute (winter) bronchitis .	5
Bronchial asthma.	2
Pneumonia.	10
Pulmonary tuberculosis.	1
Diffuse pulmonary fibrosis (? aetiology).	1
Bronchiectasis	2
Coal-workers pneumoconiosis	3

Table 2: Previous or co-existing respiratory disease.

Mixed upper respiratory tract flora.	37
Staphylococcus aureus (Coagulase positive).	5
Klebsiella pneumoniae (Friedländers bacillus).	1
Coliform organisms.	4
Haemophilus influenzae.	2
Streptococcus pneumoniae (Pneumococcus).	4
Not done/available.	13

Table 3: Bacteriology of sputum.

TYPE OF LESION			
Consolidation.		35	
Consolidation/atelectasis.		15	
Cavitation.		8	
Pleural effusion.		3	
Residual appearance	"Fibrosis"	46	
	"Normal"	4 (operation)	
Right	upper	34	21
	middle		10
	lower		10
Left	upper	17	7
	lingula		5
	lower		9

Table 4: Type and distribution of radiological lesions.

Treatment	"Residual" lesion		
	4 weeks	12 weeks	24+ weeks
Penicillin for 1 week.	1	0	2
" " 2 weeks.	4	5	2
" " 3 "	1	2	1
" " 4 "	0	3	2
" " 5 "	0	1	4
" " 6 "	0	2	1
" " 7 "	0	1	0
" " 8 "	0	3	1
" " 10 "	0	0	1
" " 12 "	0	1	1
" " 14 "	0	0	0
" " 16 "	0	1	1

Table 5: Treatment related to clearing of radiological opacity.

Dead.	5	
Untraceable.	3	
Left the country.	2	
Refused to attend.	3	
Seen at 6 months.	6	} 35
" " 1 year.	1	
" " $1\frac{1}{2}$ years.	5	
" " 2 "	2	
" " $2\frac{1}{2}$ "	4	
" " 3 "	4	
" " $3\frac{1}{2}$ "	8	
" " 4 "	0	
" " $4\frac{1}{2}$ "	2	
" " 5 "	0	
" " $5\frac{1}{2}$ "	3	

Table 6: Follow-up study.

	Bronchogram abnormal	Bronchogram normal	Not done
No respiratory symptoms.	4	0	15
Slight or moderate (no worse).	6	2	7
Considerable (worse).	0	0	1

Table 7: Respiratory symptoms related to bronchial abnormality.

Author	Year	Type of Study	Percentage of cases examined showing organisation or delayed resolution.	Remarks
Milne	1911	Post-mortem	6.3	95 cases lobar pneumonia. 65 cases broncho-pneumonia.
Floyd	1922	Post-mortem	3.6	249 autopsies. "Organising pneumonia not a rare lesion at autopsy". Floyd.
Symmers and Hoffman	1923	Post-mortem	3.2	125 cases lobar pneumonia.
Lord	1928	Post-mortem	7.6	210 cases lobar pneumonia.
Lauche	1928	Post-mortem	1-6	-
Gleichman, Leder and Zahn	1949	Clinical	26.2	Arbitrary time limit of 30 days beyond which "delayed resolution" regarded as present. Some selection of cases.
Auerbach, Mims and Goodpasture	1952	Post-mortem	12	307 cases pneumonia.

Table 8: The frequency of organising pneumonia.

Case	Age	Sex	Total Duration of Symptoms	Duration of Antibiotic Therapy	Bronchography	Bacteriology of Sputum	Pathology
P.McG.	60	M	15 weeks	6 weeks	Bronchiectasis in anterior segment of R.U.L. and 2 large irregular areas of parenchymatous destruction in anterior and posterior segments.	Mixed U.R.T. organisms. Moderate growth of <i>H. influenzae</i> .	Organised and organising pneumonia. (Fig. 10)
J.L.	57	M	28 weeks	8 weeks	Distortion of anterior segment bronchus of L.U.L.	Mixed U.R.T. organisms. Profuse growth of coliform organisms.	Organised pneumonia. (Fig. 9a & b) Dilated, pus-filled bronchioles.
P.McI.	28	M	32 weeks	25 weeks	Distortion and dilation of R.U. and M.L. bronchi. (Fig. 16a, b and c)	Mixed U.R.T. organisms. Occasional growth of coliform bacilli.	Organised pneumonia. Several small cavities. (Fig. 17a and b)

Table 9: Details of cases submitted to pulmonary resection because of persistent symptoms.

ILLUSTRATIONS AND FIGURES

Fig. 1a.

Pneumonic consolidation involving
the right upper lobe.

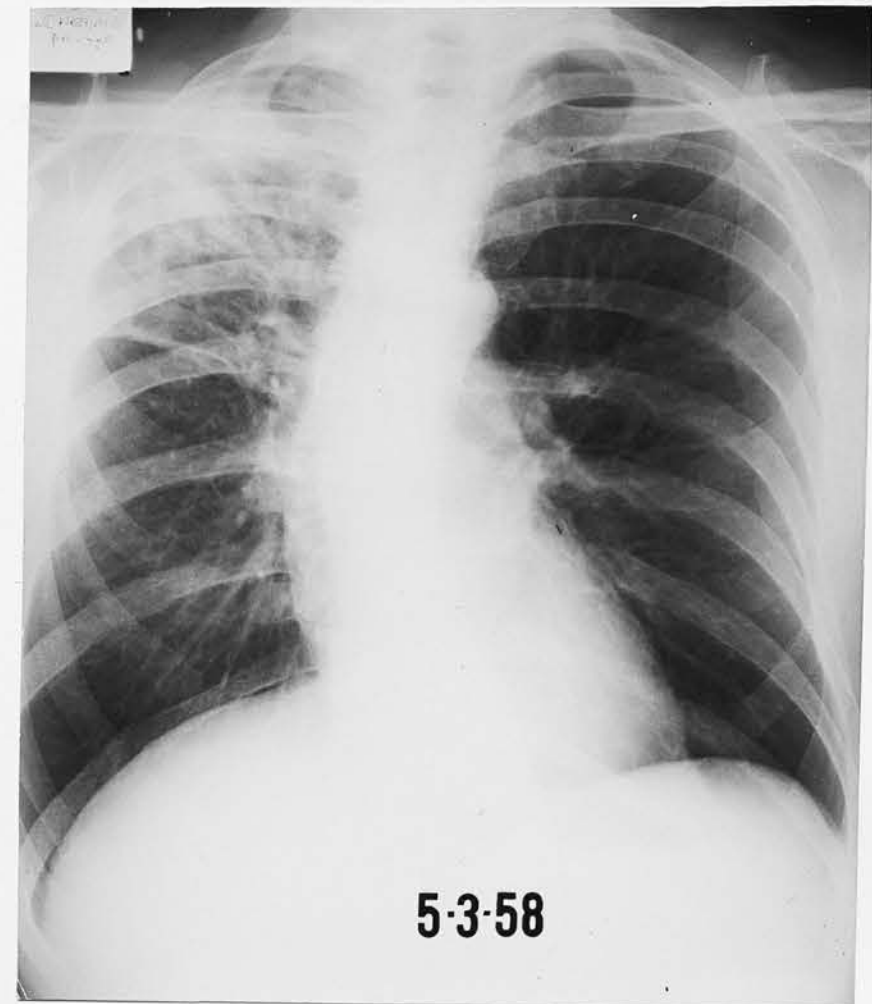


Fig. 1b.

Incomplete resolution one month from onset.

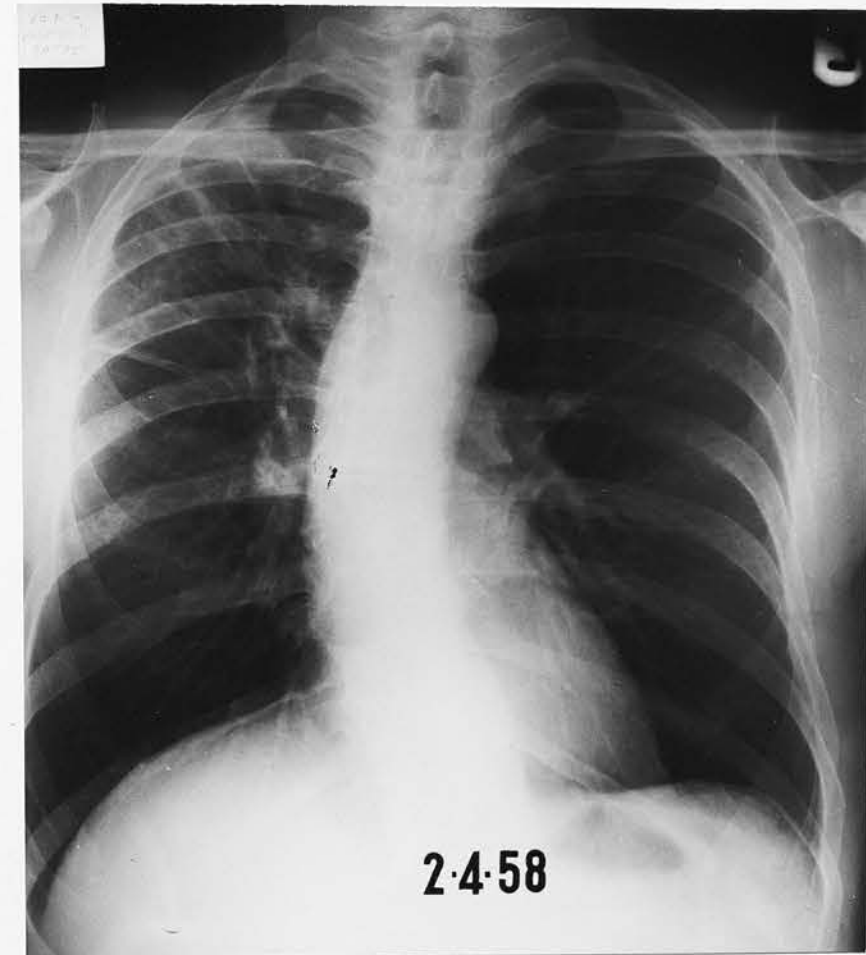
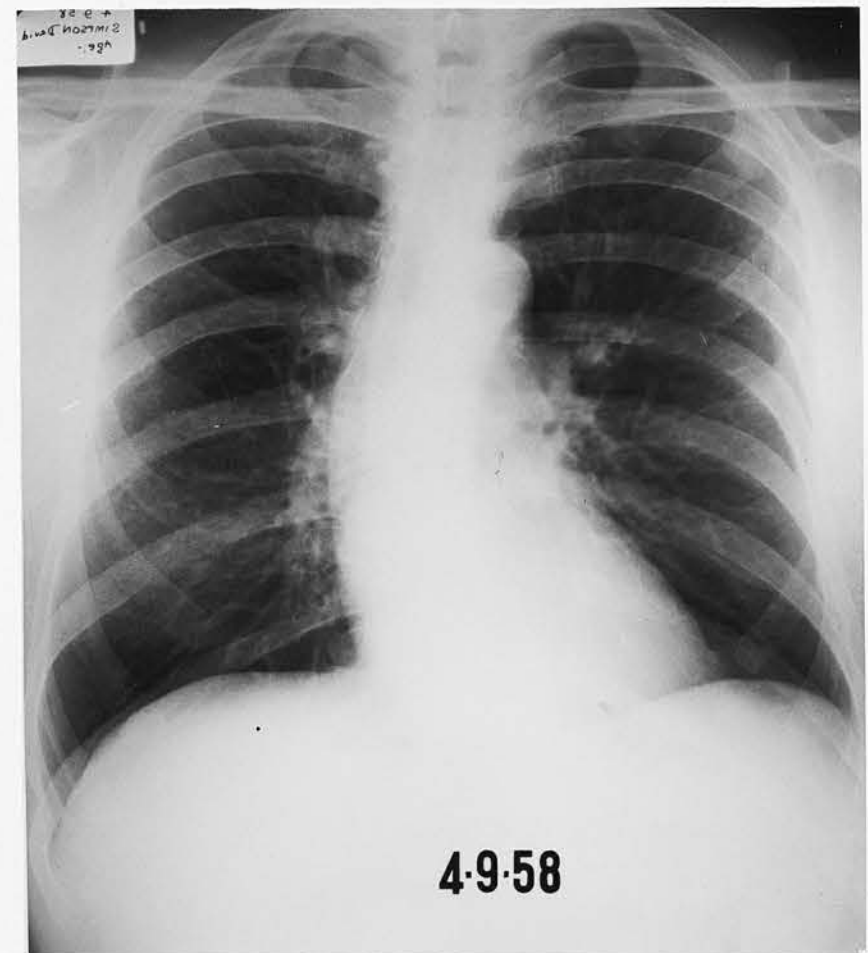


Fig. 1c.

Complete resolution six months from onset.



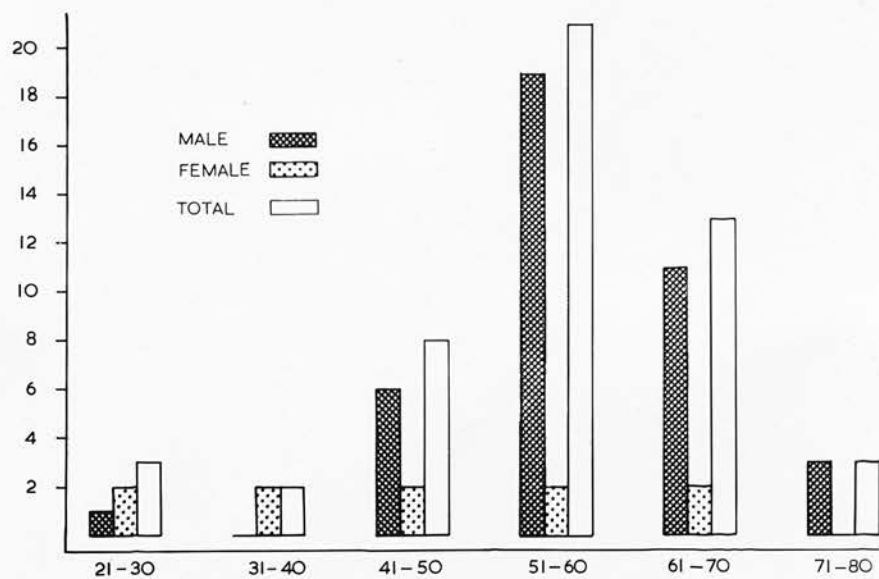


Fig. 2.

AGE & SEX DISTRIBUTION.

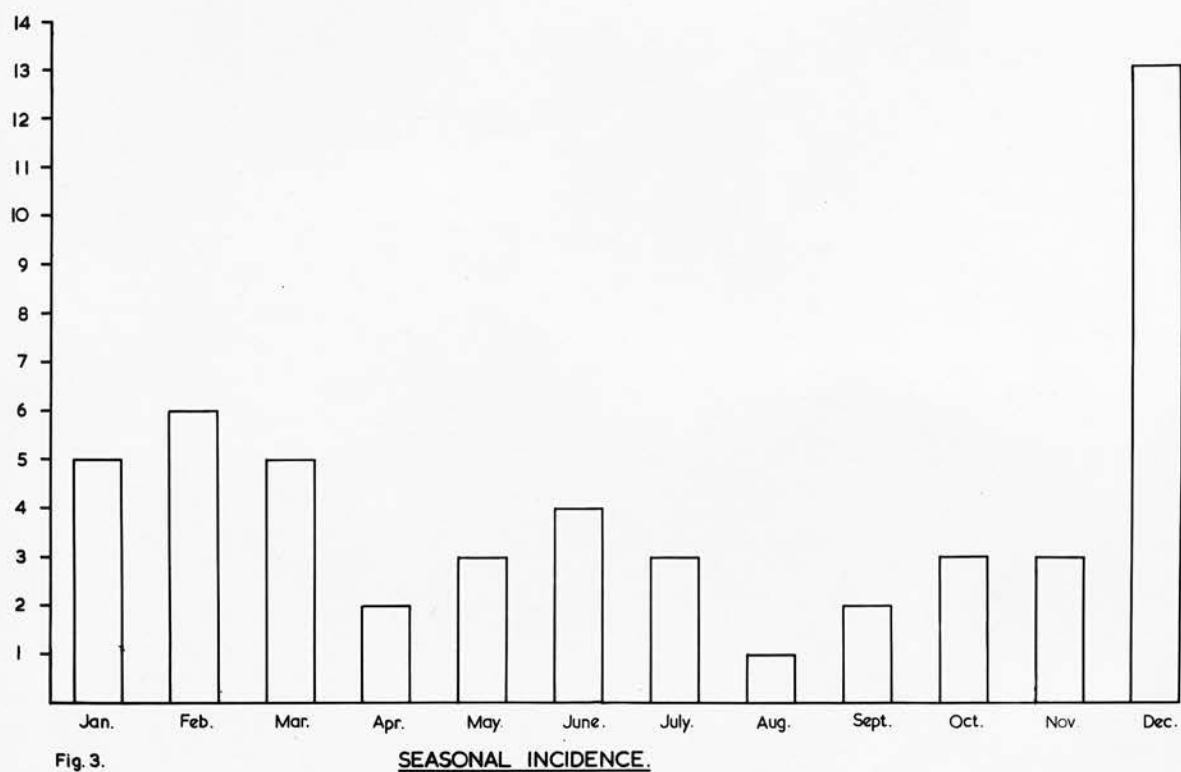


Fig. 3.

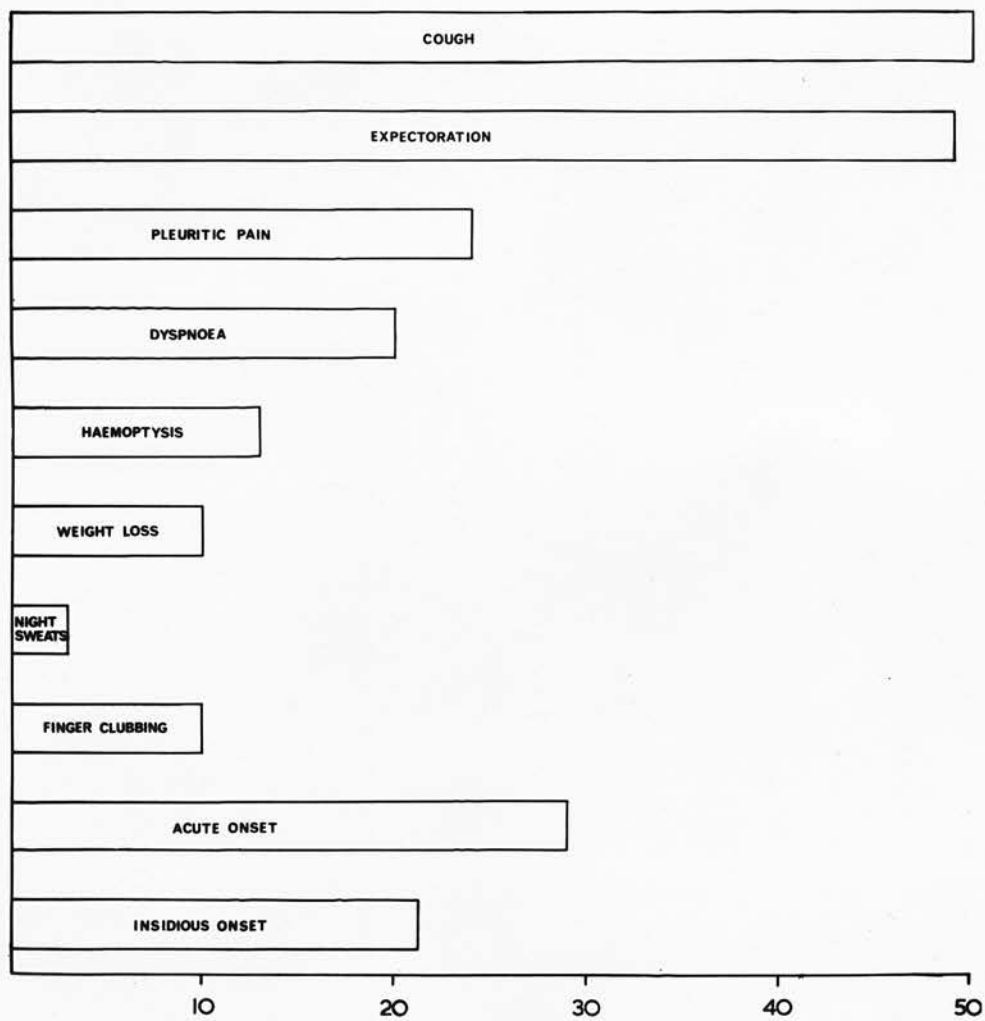


Fig. 4.

FREQUENCY OF CLINICAL FEATURES.

Fig. 5a.

Pneumonic consolidation involving the right
upper lobe.



Fig. 5b.

Considerable clearing of opacity after three
months.



Fig. 5c.

Persisting streaky opacities one year later.

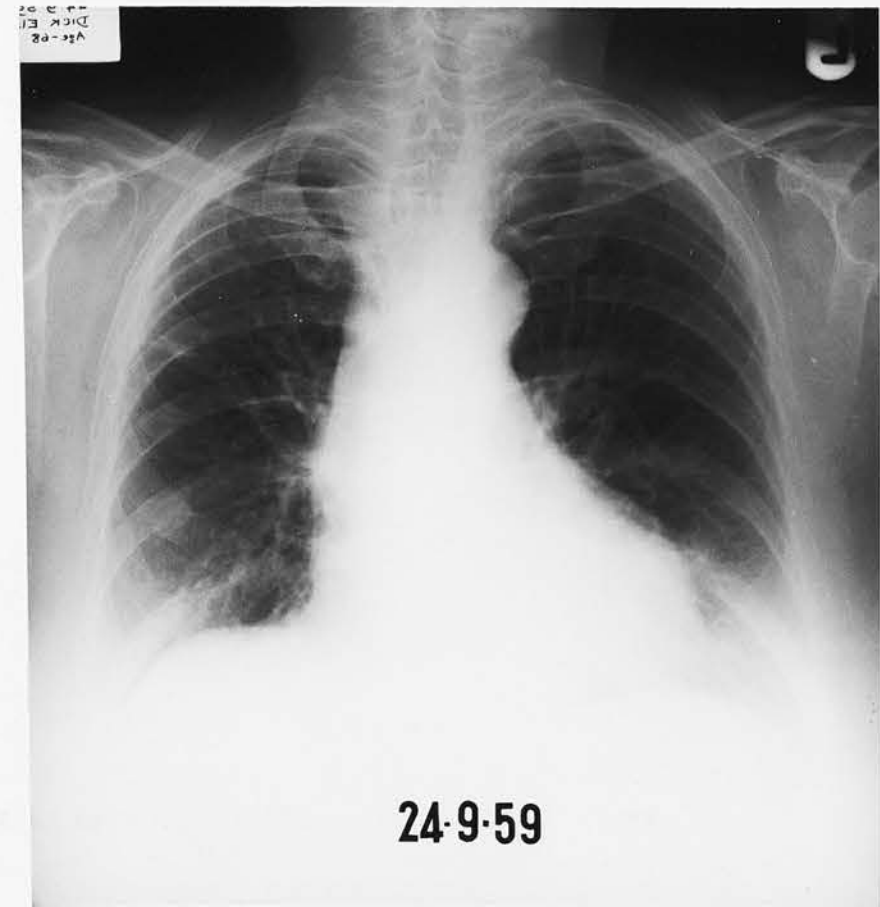


Fig. 6a.

Pneumonic consolidation in the right upper lobe.

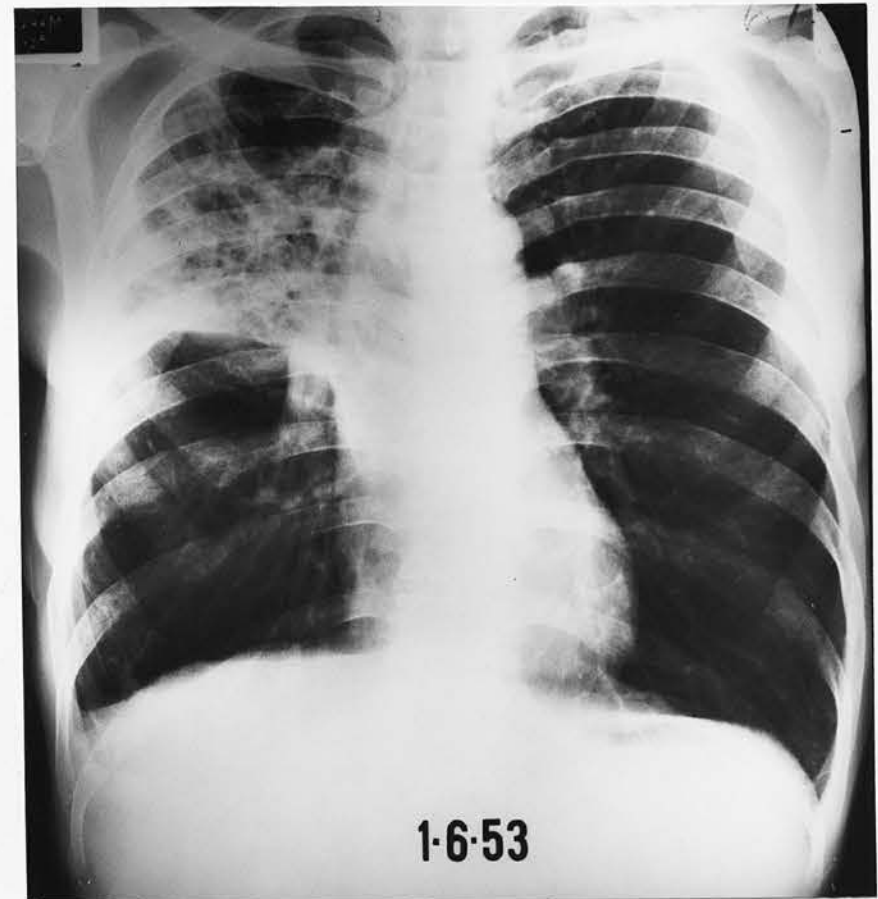


Fig. 6b.

Incomplete resolution five months later.

(Lipiodol residues are seen in both right upper and lower lobes).

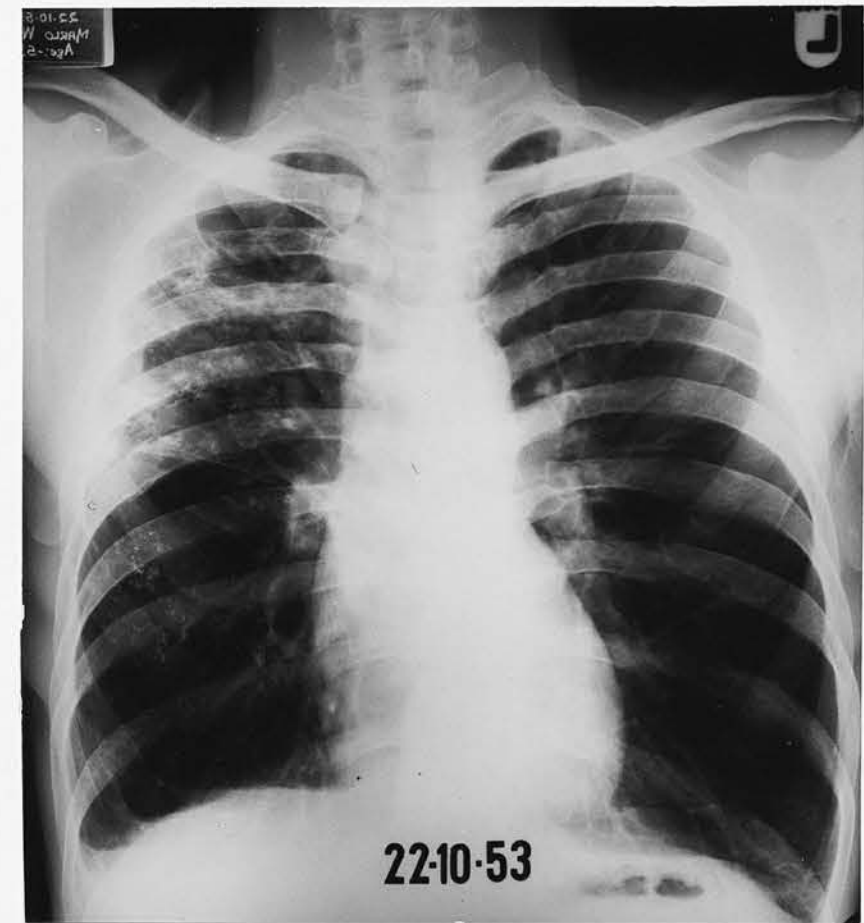


Fig. 6c.

Bronchogram. Crowding and distortion of
right upper lobe bronchi.



Fig. 7.

Pneumonic consolidation involving right upper lobe and left lower lobe.

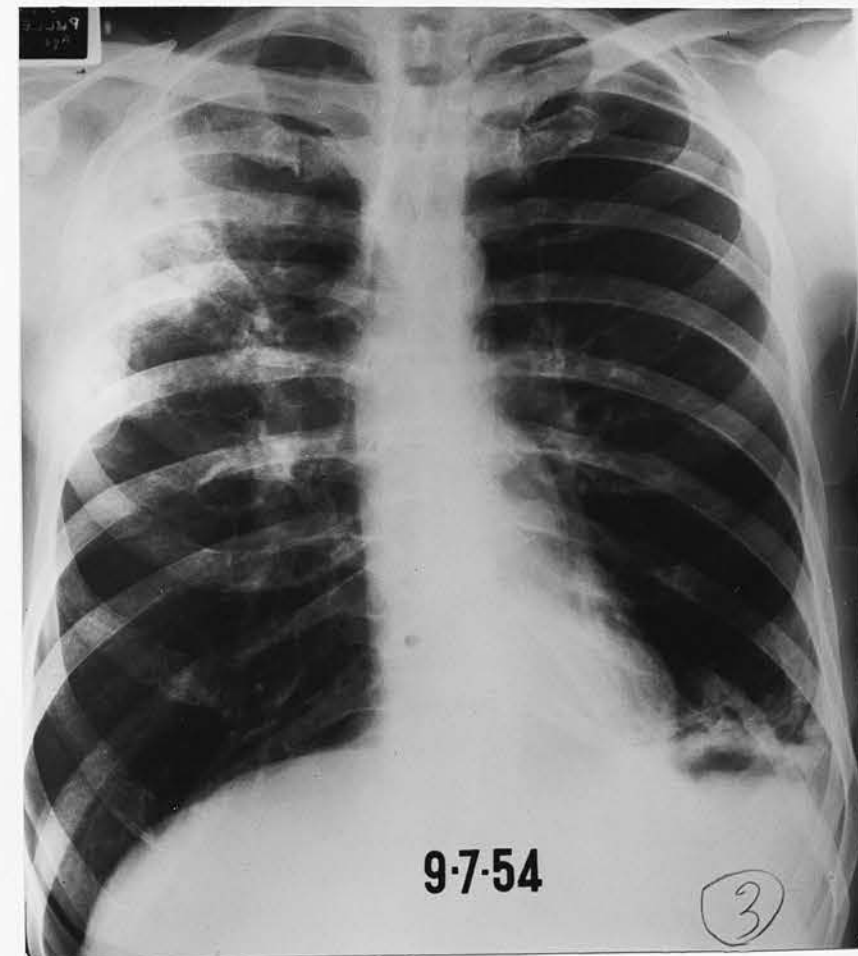


Fig. 8a.

Consolidation involving right middle lobe and
anterior segment of right lower lobe.

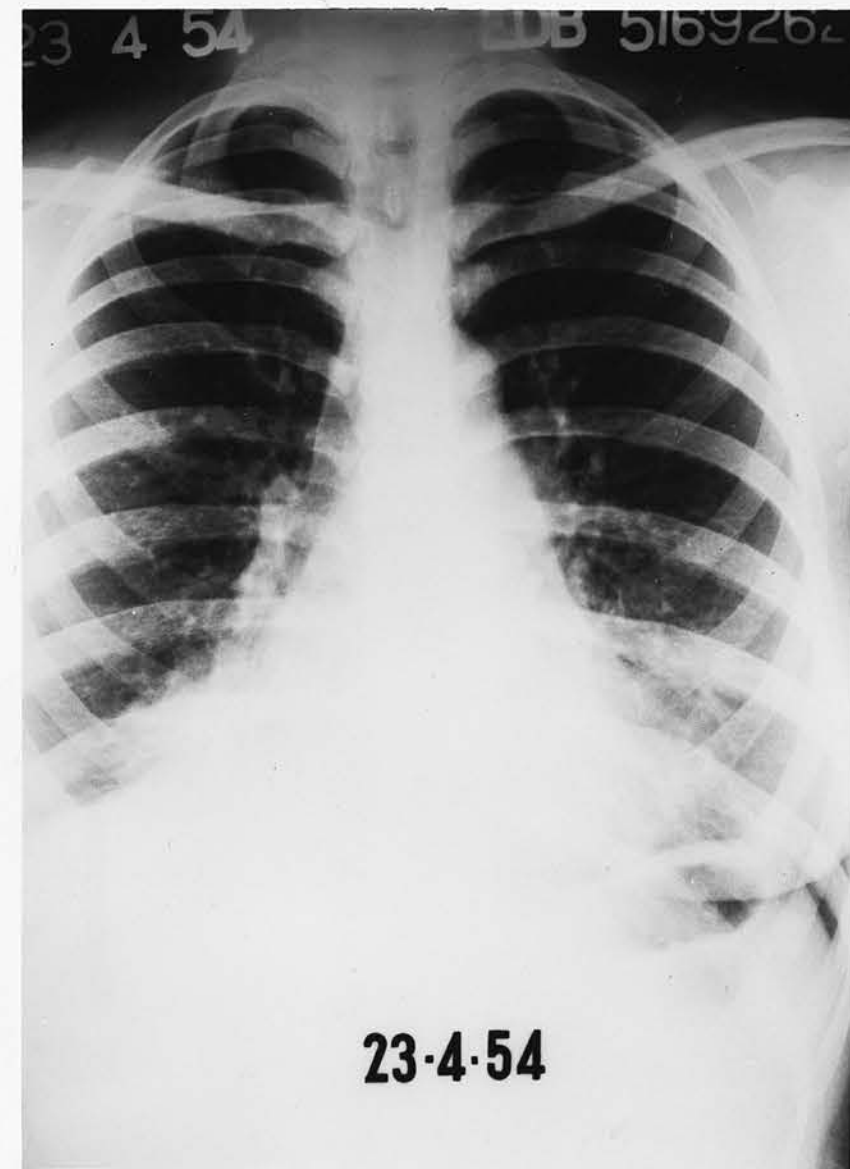


Fig. 8b.

Bronchogram. Bronchiectasis in right middle
and lower lobes.

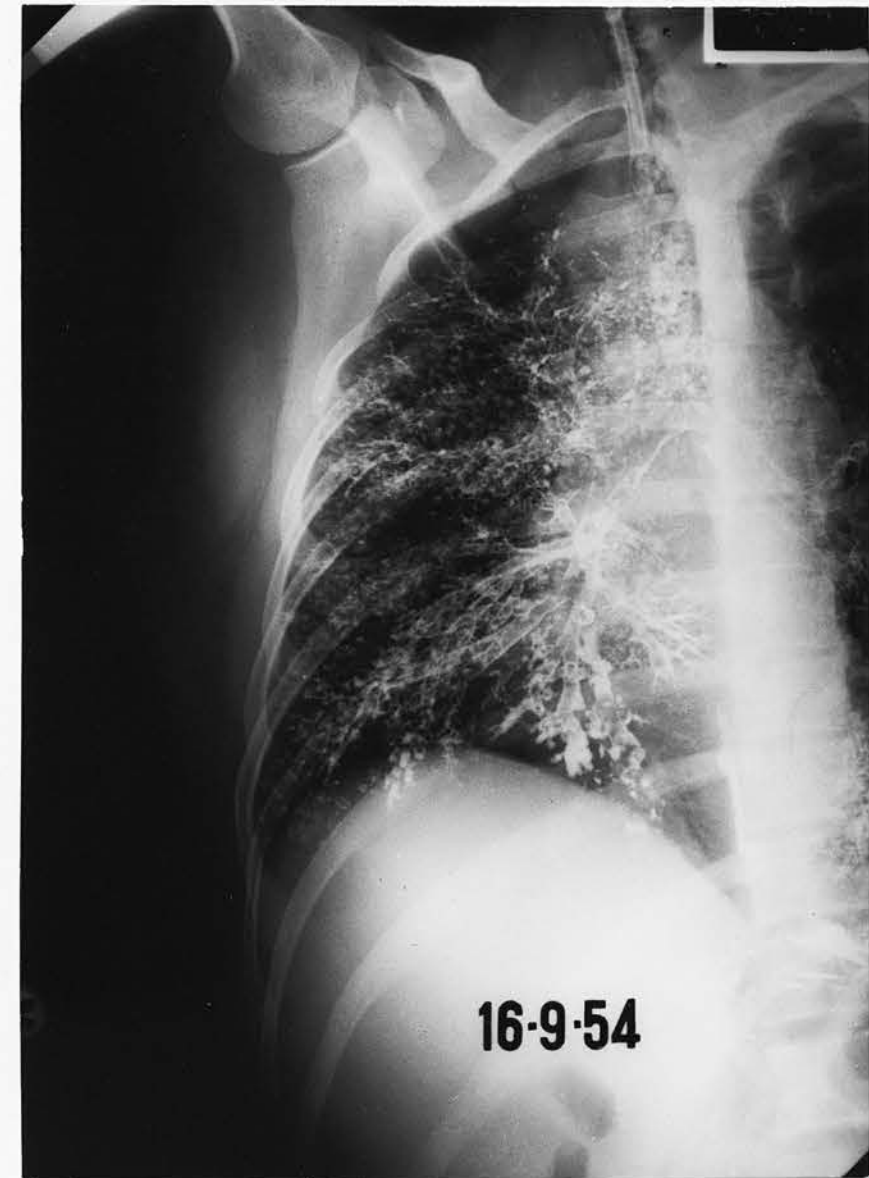


Fig. 9a.

Organised alveolar exudate with fibrous tissue
lying in alveolar spaces. x 110.



Fig. 9b.

A higher power view of "whorls" of fibrous tissue
in alveolar spaces. x 350.

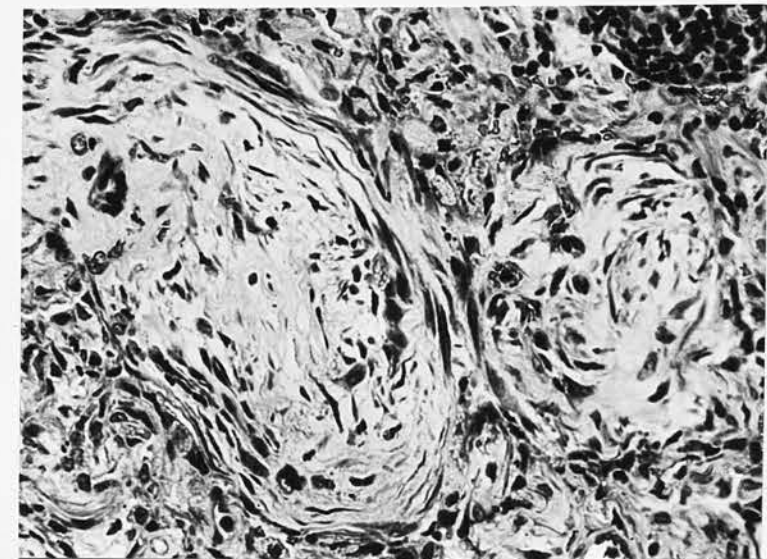


Fig. 10.

Organisation of alveolar exudate with marked
round-cell infiltration. x 150.

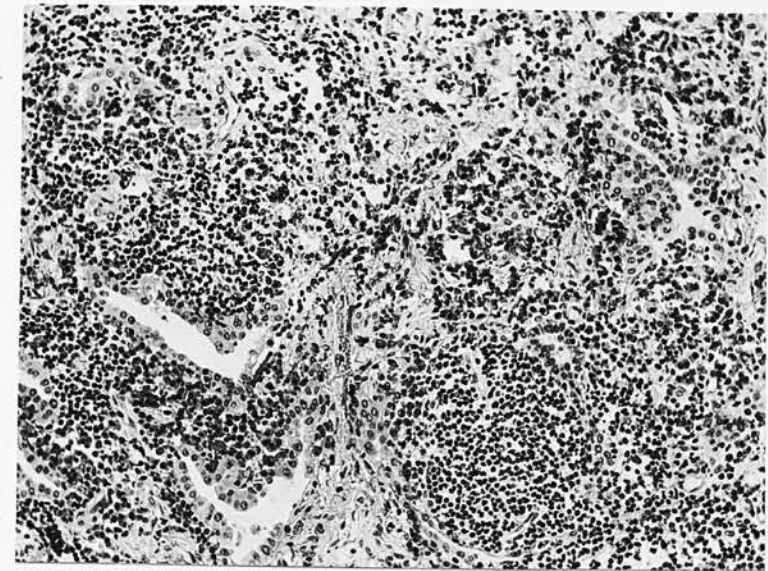


Fig. 11.

"Lipoid pneumonia". Alveolar spaces crowded with
lipoid-containing macrophages. x 400.

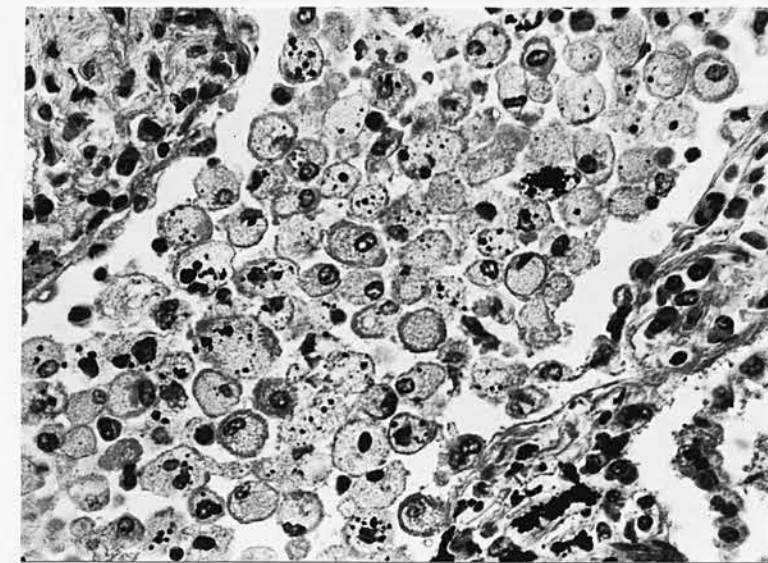


Fig. 12a.

Mr. D.V. A normal chest radiograph taken at a routine medical examination three months before the patient's illness.

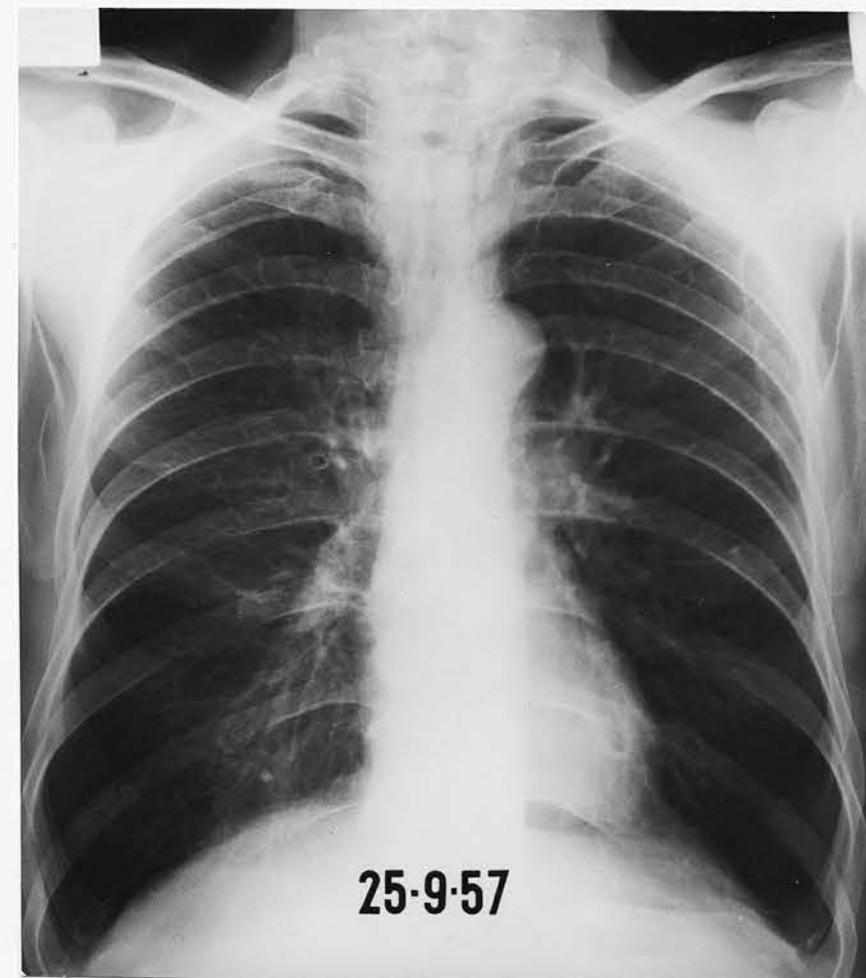


Fig. 12b.

Chest radiograph on admission to hospital showing consolidation and atelectasis in the left upper lobe.



Fig. 12c.

Five months later. Considerable improvement
but the left upper lobe is fibrotic and atelectatic.



Fig. 12d.

Two years after the illness the appearances are virtually the same as those in May 1958. The left hemidiaphragm remains elevated and paralysed.

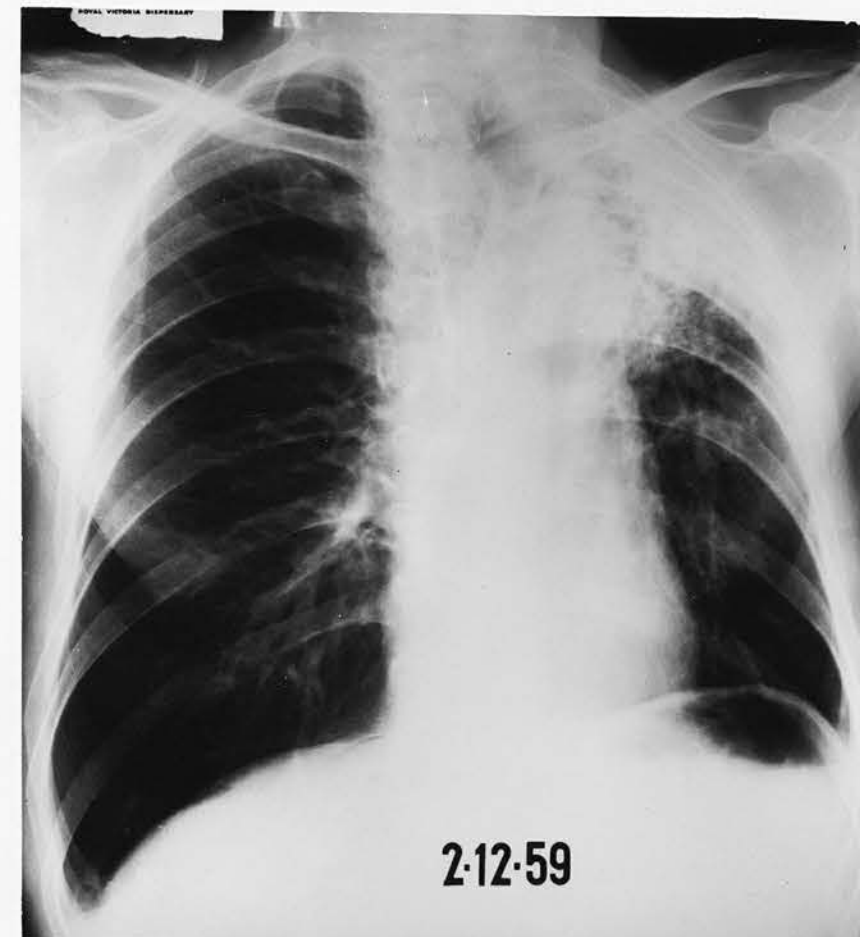


Fig. 13a.

Mr. F.C. Pneumonic consolidation in the apical
and lateral basal segments of the right lower lobe.

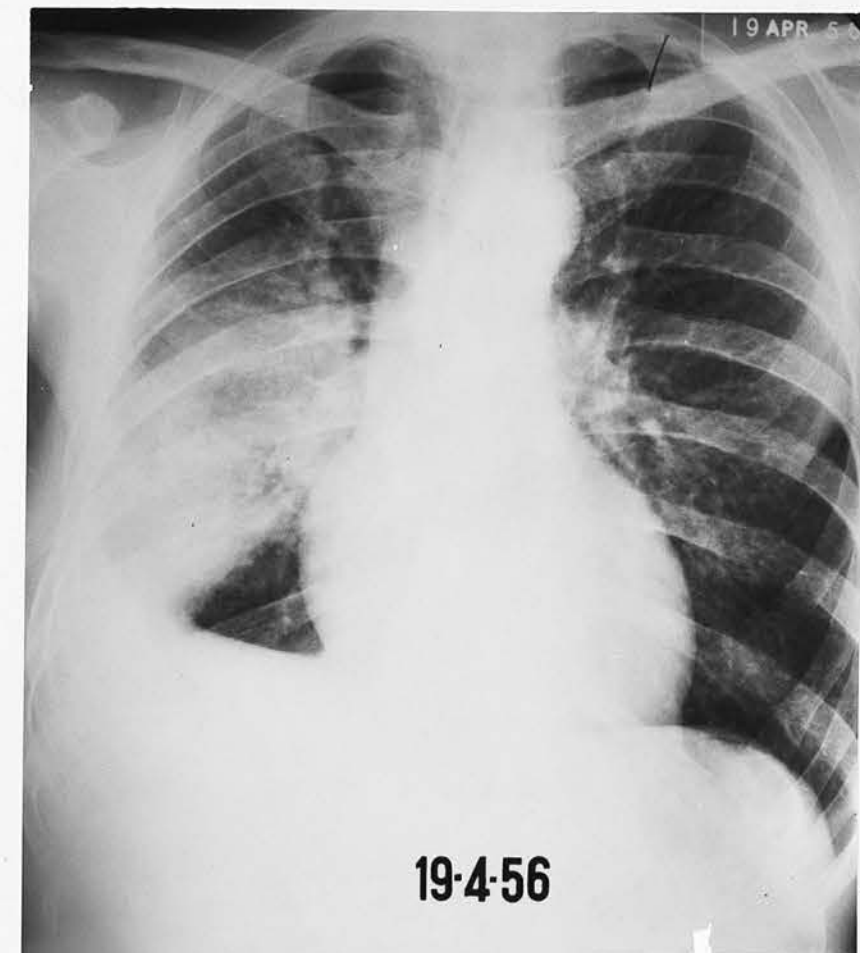


Fig. 13b.

A right lateral chest radiograph of the same patient.



Fig. 14a.

Mr. J.B. Left perihilar opacity.

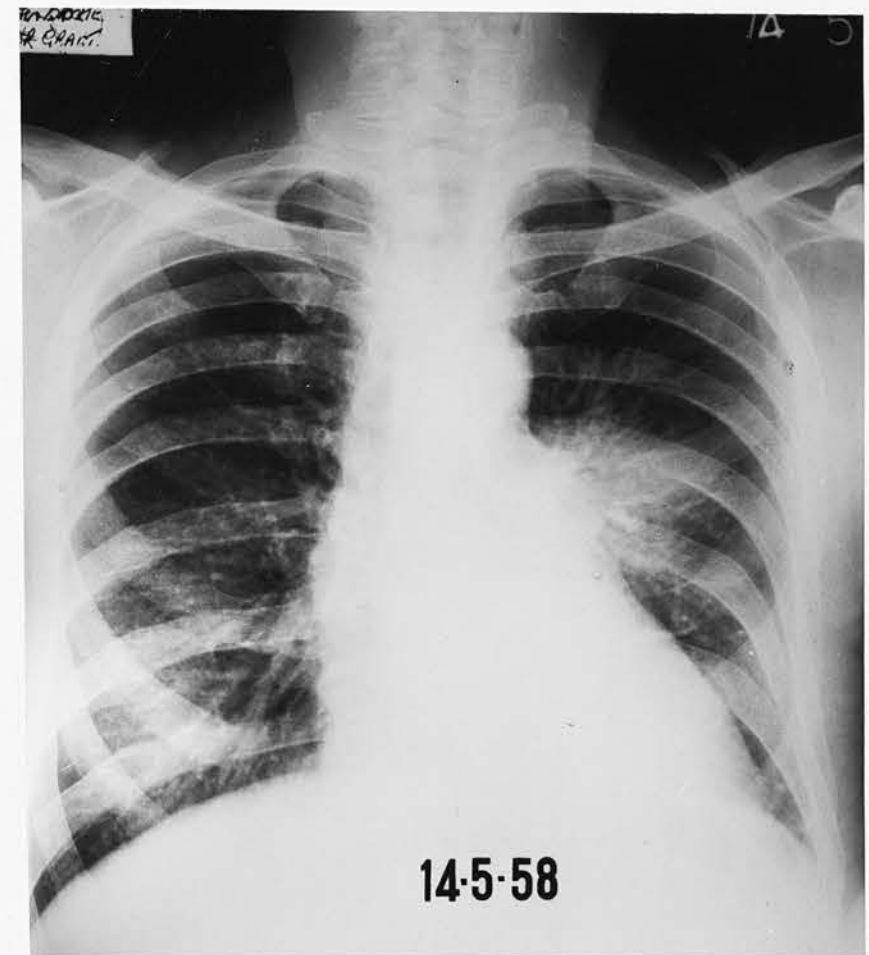


Fig. 14b.

A left lateral chest radiograph showing
consolidation in the apical segment of the
left lower lobe.

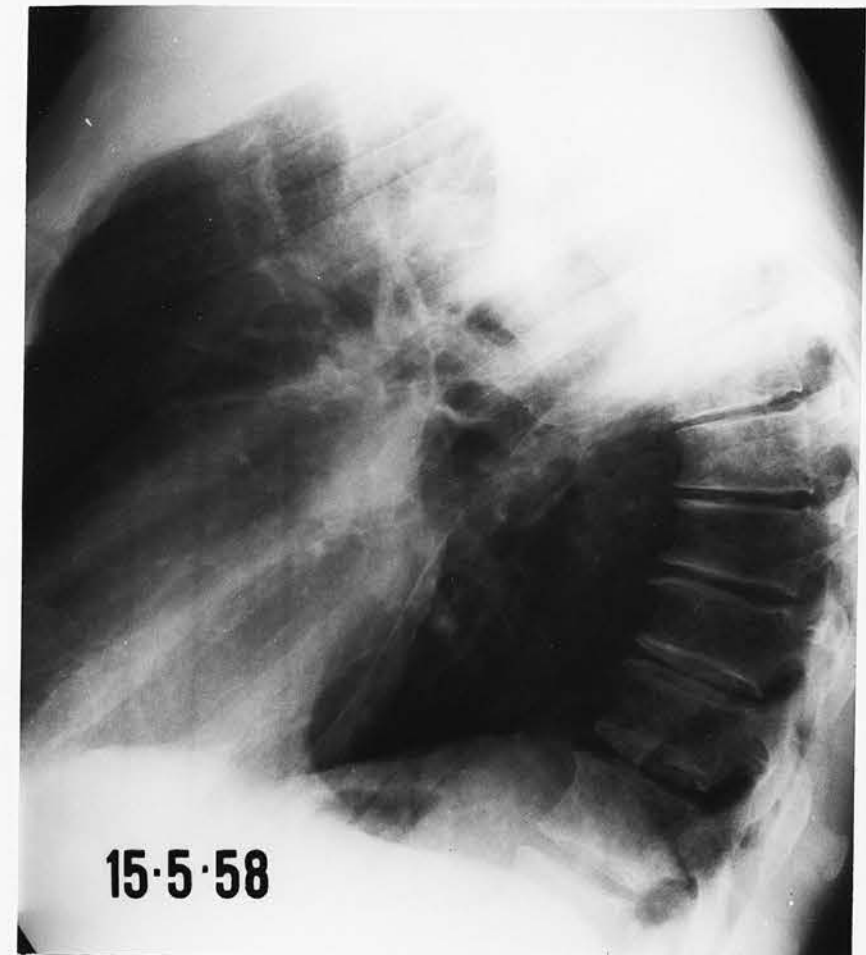


Fig. 15a.

Mr. J.B. Replacement of normal lung parenchyma
by dense fibrous tissue. x 100.

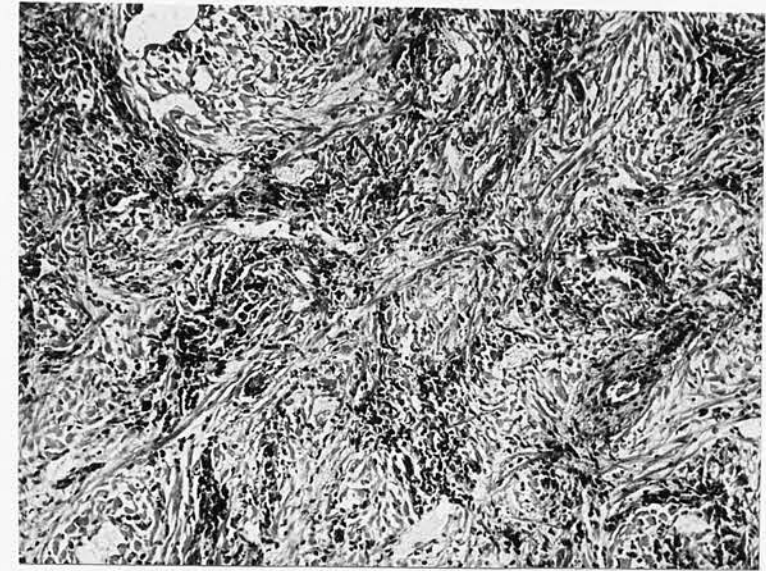


Fig. 15b.

Cuboidal epithelial metaplasia. x 325.

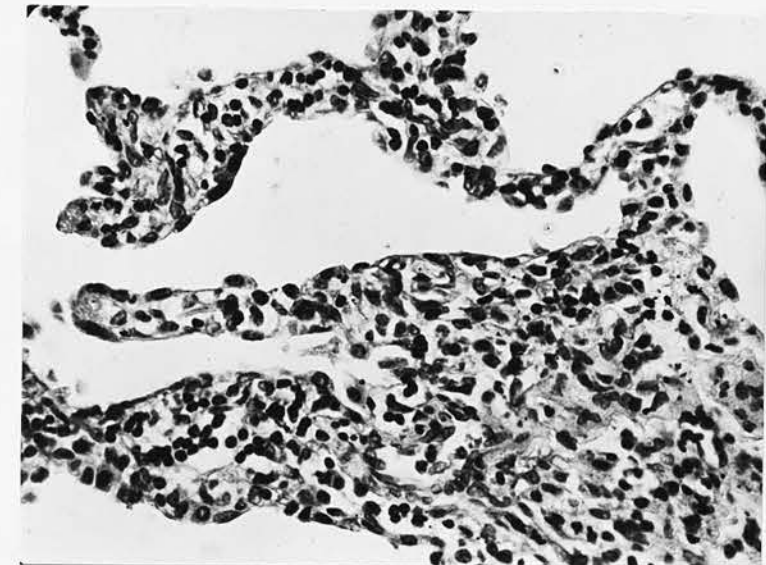


Fig. 16a.

Mr. P.McI. Pneumonic consolidation in the right middle lobe and anterior and posterior segments of the right upper lobe.

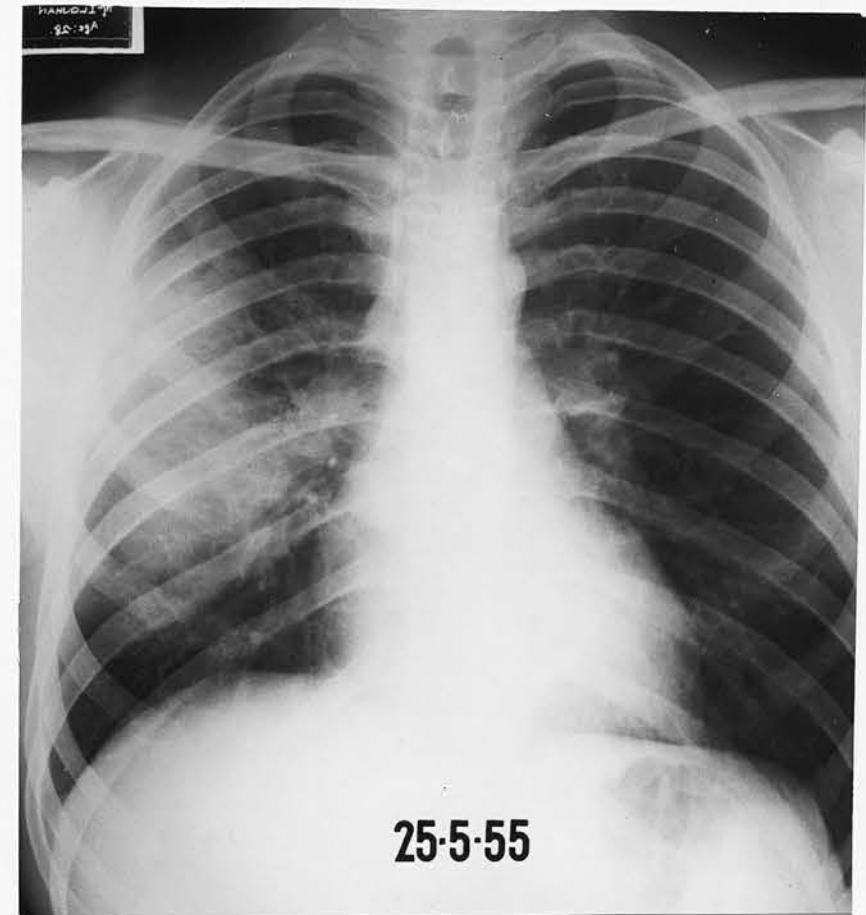


Fig. 16b.

After three months intensive antibiotic therapy,
the clearing of opacity has been moderate only.



Fig. 16c.

Bronchogram. Distortion and dilatation of bronchi
in the right middle lobe and anterior segment of
the upper lobe.



Fig. 17a.

Mr. P.McI. Replacement of lung tissue by fibrosis and round cell infiltration. A bronchiole is surrounded by atelectatic lung parenchyma and there is a general increase in lymphoid tissue forming small follicles. x 90.



Fig. 17b.

An area of consolidated lung containing many eosinophil polymorphs. x 150.

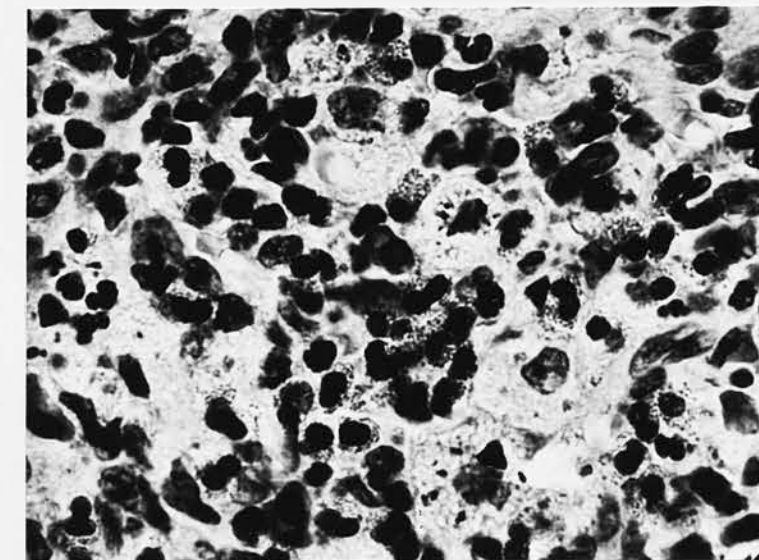


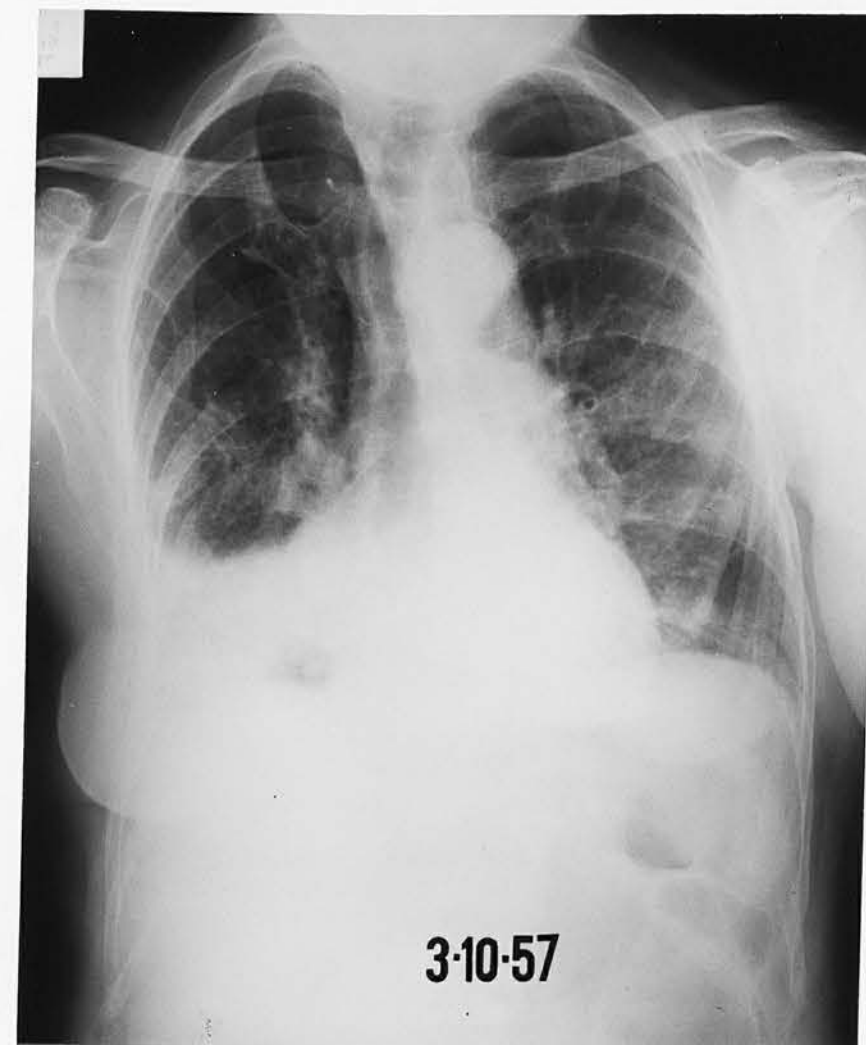
Fig. 18a.

Miss A.B. Pneumonic consolidation in the
right lower lobe.



Fig. 18b.

Virtually no improvement after three months and
treatment with penicillin and chloramphenicol.



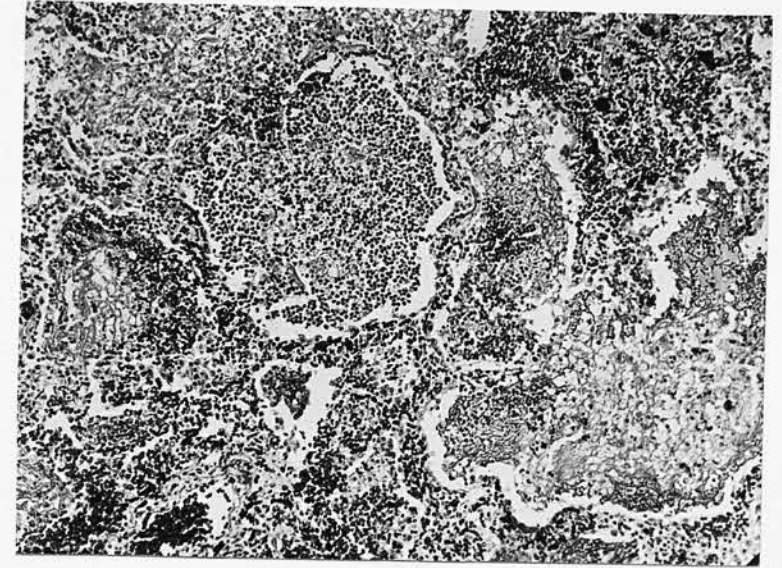


Fig. 19.

Miss A.B. Organisation of alveolar exudate.
x 100.

Fig. 20a.

Pneumonic consolidation in the
right middle lobe.

Fig. 20b.

Failure to clear with penicillin
and streptomycin.

Fig. 20c.

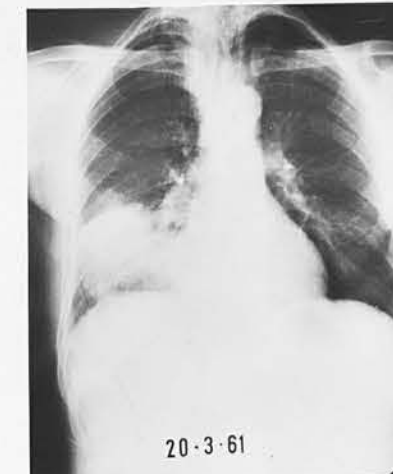
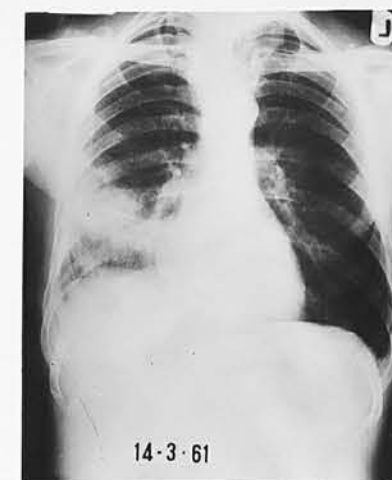
Further failure to clear with
demethylchlortetracycline.

Fig. 20d.

Apparent clearing after
administration of prednisolone.

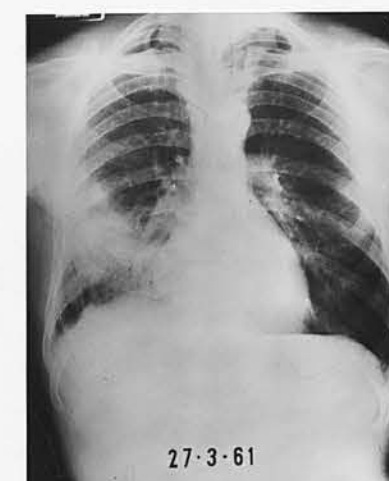
Fig. 20e.

Further slight improvement.



PENICILLIN 2 M.U. DAILY

STREPTOMYCIN 2 G. DAILY



DEMETHYLCHLORTETRACYCLINE 1.2 G. DAILY

PREDNISOLONE 20 MG. DAILY

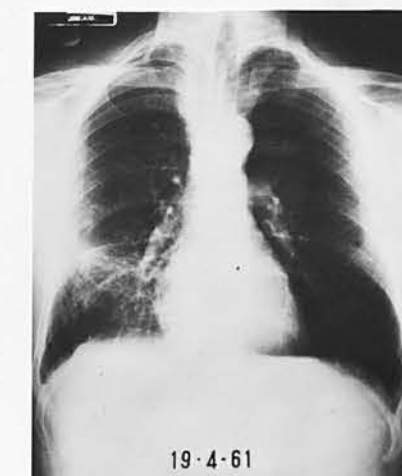


Fig. 21a.

Pneumonic consolidation in the right upper lobe.

Fig. 21b.

Slight and slow improvement after antibiotics.

Fig. 21c.

Further and more rapid clearing with addition of prednisolone.

Fig. 21d.

Further slight improvement.

Fig. 21e.

Further improvement.

Fig. 21f.

Minimal residual fibrosis.



27.4.62.

PENICILLIN 2 M.U. DAILY.



22.5.62.

AMPICILLIN 1G. 3G. DAILY

PREDNISOLONE 60MG.
4 DAILY.



5.6.62.

STREPTOMYCIN 1G. DAILY. AMPICILLIN 1G. DAILY



14.6.62.

PREDNISOLONE 15 MG. DAILY.



3.7.62.



2.8.62.

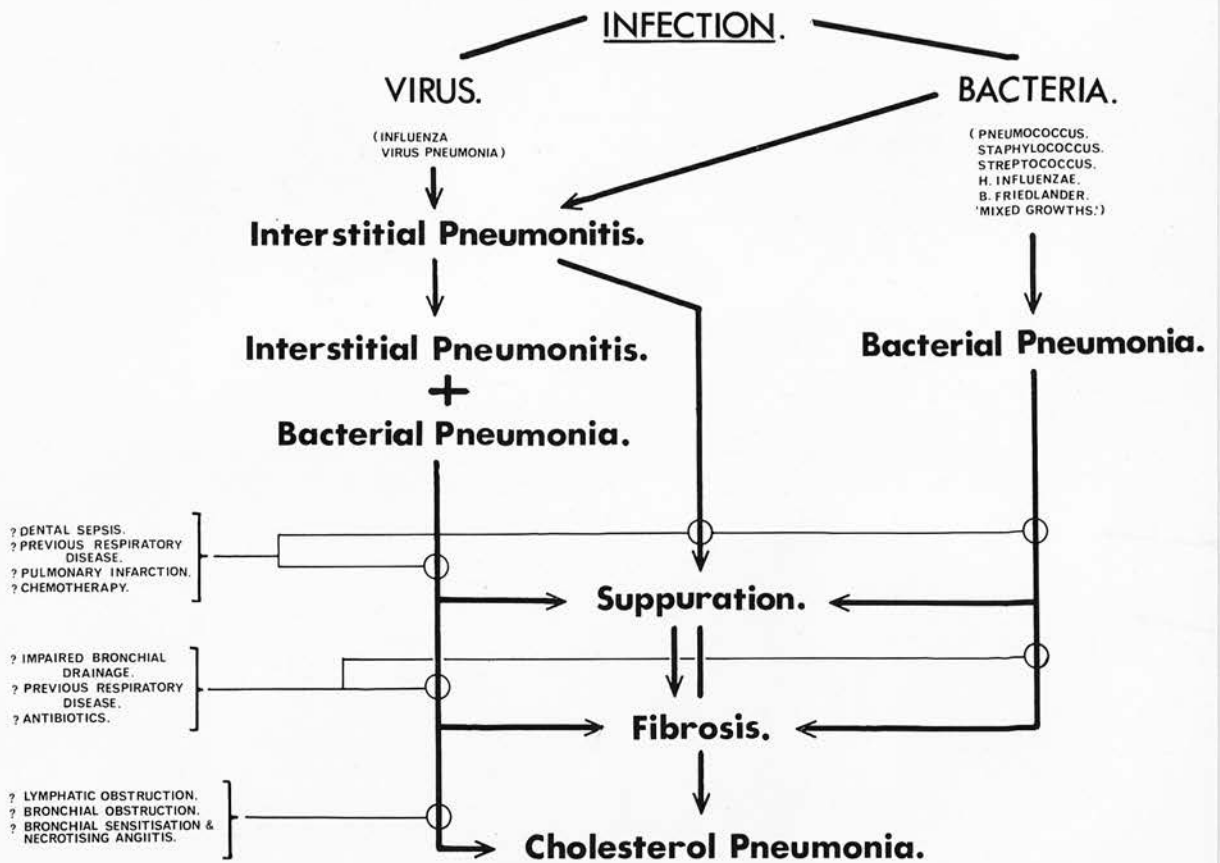


Fig. 22.

SCHMATIC REPRESENTATION OF PATHOGENESIS.

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APPENDIX

SUMMARY OF CASES

Case 1. A. McD. Female. 40 years. Housewife.

History. She had lassitude for two weeks before developing acute respiratory infection with fever, cough and purulent sputum and pleuritic pain. There was no response to sulphonamides given at home and she was admitted to hospital after slight haemoptysis. Four years previously she had had pneumonia followed by persistent cough and muco-purulent sputum.

Physical Examination and Investigations. Dullness to percussion and numerous coarse crepitations over right lower axilla. Increased nail-bed fluctuation.

W.C.C. 8,400/c.mm.

Chest radiograph. Consolidation in anterior and lateral basal segments of right lower lobe.

Bronchogram. Bronchiectasis in anterior and lateral basal segments of right lower lobe.

Bronchoscopy. Pus in right lower lobe bronchus only.

Bacteriology of sputum. Mixed upper respiratory tract (U.R.T.) organisms.

Treatment. /

Treatment. Penicillin 2 mega units daily for three weeks.

Result. Seen five and a half years later her general condition was quite good although she had persistent cough and sputum. Chest radiograph showed residual fibrotic streaking in the right lower lobe.

Case 2. W.M. Male. 55 years. Railway Worker.

History. Chronic bronchitis for twenty years. Sudden onset of headache, tiredness and slight breathlessness five days before admission. Mild right-sided pleuritic pain at same time. Slight cough with only mucoid sputum.

Physical Examination and Investigations. Signs of moderate chronic bronchitis and consolidation in the right upper lobe. No finger clubbing.

W.C.C. 9,150/c.mm.

Chest radiograph. Consolidation with slight contraction of right upper lobe. (Fig. 6)

Bronchogram. Distortion only of right upper lobe bronchi.

Bronchoscopy. Negative.

Bacteriology of Sputum. Mixed U.R.T. organisms.

Treatment. /

Treatment. Penicillin 2 mega units daily for ten weeks.

Result. Moderate improvement with, at six months, slight contraction and residual fibrosis in the right upper lobe. Died at home two years later following an acute respiratory infection.

Case 3. H.S. Female. 45 years. Housewife.

History. Three weeks before admission she felt tired and breathless and developed cough and purulent sputum. For a few days there was right-sided chest pain. She had lost weight for three weeks. She was known to have inactive pulmonary tuberculosis, idiopathic epilepsy, mitral stenosis and iron deficiency anaemia.

Physical Examination and Investigations. Occasional medium crepitations at the right upper zone anteriorly. Minimal finger clubbing. Typical auscultatory signs of mitral stenosis.

W.C.C. 12,050/c.mm.

Chest radiograph. Patchy consolidation in anterior segment of right upper lobe. Minimal fibrotic tuberculosis at both apices.

Bronchoscopy. /

Bronchoscopy. Pus seen in orifice of right upper lobe bronchus.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Sulphadimidine 3G. daily for one week followed by penicillin 1 mega unit daily for three weeks and 2 mega units daily for two weeks.

Result. At six months there had been considerable clearing of radiological opacity with residual fibrosis remaining. One year later she died at home, a diagnosis of "cerebral vascular accident" being made.

Case 4. J.H. Male. 65 years. House Painter.

History. Admitted to hospital with four days history of fever, cough, mucoid sputum and right pleuritic pain. He also admitted to symptoms suggestive of mild chronic bronchitis and emphysema.

Physical Examination and Investigations. Dullness to percussion, diminished air entry and crepitations at right upper zone anteriorly. Occasional rhonchi over both lung fields. No finger clubbing.

Chest radiograph. /

Chest radiograph. Consolidation/atelectasis in anterior segment of right upper lobe.

Treatment. Sulphadimidine for one week, penicillin for three weeks.

Result. Radiological clearing initially slow but thereafter considerable leaving only minimal fibrosis in right upper zone. He died some months later of gastric carcinoma.

Case 5. W.R. Male. 58 years. Lorry Driver.

History. Developed head cold followed by cough and blood-stained purulent sputum three months before admission. He also complained of lassitude and slight breathlessness on exertion. He had moderate chronic bronchitis and emphysema and had had "pneumonia" about six months before this.

Physical Examination and Investigations. Typical signs of moderate chronic bronchitis and emphysema; numerous medium crepitations at left lung base. No finger clubbing.

W.C.C. 9,400/c.mm.

Chest radiograph. Patchy consolidation in the left lower lobe. Minimal fibrotic tuberculosis at the right apex.

Bronchogram. /

Bronchogram. Crowding but no bronchiectasis of left lower lobe bronchi.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 2 mega units daily for four weeks.

Result. Slow radiological clearing with residual fibrosis and contraction in the left lower lobe.

This man could not be traced for follow-up examination.

Case 6. M.H. Female. 27 years. Housewife.

History. A month before admission she developed an upper respiratory tract infection followed in a few days by cough and purulent sputum. Cough persisted and she was referred to an M.M.R. unit, where a radiological opacity was discovered.

Physical Examination and Investigations. Occasional crepitations at right lower axilla only. No finger clubbing.

Chest radiograph. Consolidation in anterior segment of right lower lobe and in right middle lobe. (Fig. 8a and b)

Bronchography. Bronchiectasis in right middle and lower lobes.

Bronchoscopy. /

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 1 mega unit daily for two weeks.

Chloramphenicol 2G. daily for one week.

Result. Slow resolution with residual opacity in right lower zone. At follow-up examination five years later, she admitted to no respiratory symptoms and indeed considered herself normal in every respect. Chest radiograph showed the same minimal fibrotic opacities in the right lower zone.

Case 7. A.P. Male. 54 years. Labourer.

History. Shivering and malaise followed a few days later by cough, purulent sputum and right-sided pleuritic pain. Given oral penicillin at home but cough and sputum persisted. Admitted to hospital one month later. In 1928 he had had left-sided pneumonia and empyema.

Physical Examination and Investigations. Percussion note impaired over right upper lobe. Numerous medium crepitations at this area. No finger clubbing.

W.C.C. 11,300/c.mm.

Chest radiograph. /

Chest radiograph. Consolidation in the posterior segment of right upper lobe and in left lower lobe. (Fig. 7)
Tomographs showed a 1 cm. cavity in right upper lobe.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin orally for one week and 2 mega units daily by injection for six weeks.

Result. Slow resolution but cavity closed in right lower lobe. At follow-up examination five years later he admitted to slight morning cough with minimal mucoid sputum only. Chest radiograph showed fibrosis in the right upper lobe.

Case 8. J.R. Male, 65 years. Commercial Traveller.

History. Four months before admission he had complained of shivering, malaise, cough and greyish sputum. Cough with occasionally purulent sputum persisted and he also became weak, anorexic and lost weight. Given sulphonamides with little improvement. He had suffered from recurrent acute bronchitis for many years.

Physical Examination and Investigations. Occasional crepitations and rhonchi at left upper lobe. No finger clubbing.

W.C.C. /

W.C.C. 8,000/c.mm.

Chest radiograph. Patchy consolidation in apical and posterior segments of left upper lobe. Tomography showed no cavitation.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 2 mega units daily for two weeks.

Result. Slow resolution with eventual residual fibrosis.

At follow-up examination five years later he regarded himself as having no respiratory symptoms and the chest radiograph showed no change.

Case 9. P. McI. Male. 28 years. Coal Miner.

(This case has already been described in the section on Illustrative Cases).

Case 10. P.S. Male. 75 years. Pensioner (Regular Soldier).

History. Developed cough, purulent sputum and malaise five weeks before admission. He also noticed ankle swelling and had lost weight. After five weeks in bed he felt better but cough and sputum persisted. He admitted to slight cough in the past only in association with head colds.

Physical /

Physical Examination and Investigations. Dullness to percussion and diminished air entry at left base with medium crepitations at left base and mid-axilla. Mild hypertension. Signs of mild congestive cardiac failure due to his ischaemic heart disease.

W.C.C. 9,000/c.mm.

Chest radiograph. Patchy consolidation in the posterior segment of the left upper lobe and the apical segment of the left lower lobe. Tomography revealed a cystic area in the left upper lobe. There was also a small pleural effusion on the left.

Bronchoscopy. Negative.

Treatment. Penicillin 1 mega unit daily for five days and chloramphenicol 2G. daily for seven days.

Result. After initial improvement there was recurrence of effusion and deterioration in the left upper lobe opacity. He died suddenly following pulmonary embolism.

Pathology. The left lung showed abscess formation, confluent bronchopneumonia (the cellular reaction of which was chiefly plasma cell), organisation and lipid containing macrophages. (Fig. 11)

Case 11. G.B. Male. 46 years. Engineer.

History. Six weeks before admission he developed cough and purulent sputum, retrosternal and left pleuritic pain and slight dyspnoea. He had not been off work but was referred for a chest radiograph because of persistent cough.

Physical Examination and Investigations. Slight dullness to percussion and occasional crepitations over left upper zone. Increased nail-bed fluctuation.

W.C.C. 11,400/c.mm.

E.S.R. 103 mm. in one hour.

Chest radiograph. Patchy consolidation in the anterior segment of the left upper lobe and lingula. Tomography showed two small 1 cm. cavities in the left upper lobe.

Bronchography. Bronchiectasis in the apical, posterior and anterior segments of the left upper lobe.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 2 mega units daily for six weeks.

Result. Slow improvement with eventual disappearance of cavities but with residual fibrosis in the left upper lobe. This patient could not be traced for follow-up examination.

Case 12. D.R. Male. 54 years. Maltsman.

History. Mild chronic bronchitis for thirty years.

Pneumonia in 1953. Six weeks before admission, developed right-sided pleuritic pain and malaise. He had increased cough and purulent sputum.

Physical Examination and Investigations. Typical signs of consolidation in right upper lobe. Occasional rhonchi and crepitations over both lung fields.

Chest radiograph. Consolidation in the right upper lobe. Tomography showed 1 cm. cavity at right apex.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms, with growths of staph. aureus (coagulase positive) B. Friedländer and strep. haemolyticus.

Cervical gland biopsy. Non-specific inflammatory changes only.

Treatment. Penicillin at home for one week, followed by penicillin 2 mega units daily for four weeks. Streptomycin 3G. daily for six days.

Result. Slow improvement with disappearance of cavity and residual fibrosis six months later. Four years later this man could not be traced for follow-up examination.

Case 13. J.C. Male. 62 years. Retired Insurance Agent.

History. Seven weeks before admission, developed fever, cough with mucoid sputum, with slight haemoptysis.

He had tetracycline at home for one week. In the past he had pneumonia aged 30 and intermittent winter bronchitis.

Physical Examination and Investigations. Coarse crepitations and diminished air entry at right base.

Chest radiograph. Patchy consolidation in right middle and lower lobes.

Bronchoscopy. Negative.

Treatment. Tetracycline for one week.

Result. After slow improvement, residual fibrosis and contraction of right lower lobe. At follow-up examination four years later this man could not be traced.

Case 14. A.C. Male. 67 years. Brewer.

History. Since exposure to gas in 1914 War, he had had tendency to winter bronchitis. Two weeks before admission he developed an upper respiratory infection followed by cough, and "rusty" sputum. He had vague right-sided chest pain, lassitude and shortness of breath.

Physical /

Physical Examination and Investigations. Dullness to percussion over entire right chest with harsh vesicular breath sounds and numerous medium crepitations. Bilateral leg and sacral oedema (? inferior vena caval thrombosis).

W.C.C. 15,600/c.mm.

E.S.R. 72 mm. in one hour.

Chest radiograph. Extensive consolidation atelectasis in the right lung.

Bronchography. Distorted and crowded bronchi in a shrunken right lung.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms with pneumococci predominating.

Treatment. Penicillin 2 mega units daily for eleven weeks.

Result. Slow improvement. At follow-up examination four years later he regarded himself as normal but slight contraction and fibrosis persisted in the right lung.

Case 15. /

Case 15. J.D. Male. 53 years. Bus Driver.

History. Chronic asthmatic bronchitis for twenty years. Seven weeks before admission he experienced left-sided pleuritic pain for two days. His bronchitic symptoms remained unchanged. Because of the radiological appearances he was referred for bronchoscopic examination.

Physical Examination and Investigations. Rhonchi and occasional crepitations over both sides of the chest.

W.C.C. 11,200/c.mm.

E.S.R. 5 mm. in one hour.

Chest radiograph. Patchy consolidation in the lingular segment of the left lower lobe.

Bronchography. Negative.

Bronchoscopy. Negative.

Treatment. Penicillin 1 mega unit daily for one week.

Result. Slow improvement radiologically over a period of six months. When requested to attend for follow-up examination three and a half years later, it was found that he had died six months before of an acute respiratory infection.

Case 16. R.D. Male. 51 years. Stoker.

History. Eighteen months before admission, he was off work for one month with cough, purulent sputum and haemoptysis and dyspnoea. Since that time, he had complained of slight dyspnoea and tiredness. For five weeks he had increased cough, purulent sputum, anorexia, weight loss, dyspnoea and slight left pleuritic pain.

Physical Examination and Investigations. Slight dullness to percussion and medium crepitations at left mid-zone posteriorly.

W.C.C. 8,800/c.mm.

E.S.R. 75 mm. in one hour.

Chest radiograph. Patchy consolidation in apical segment of left lower lobe. Tomography showed 0.5 cm. cavity in this segment.

Bronchography. Negative.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 1 mega unit daily for two weeks.
Chloramphenicol 2G. daily for one week.

Result. Slow radiological clearing but with residual fibrosis remaining at six months. When asked to attend for follow-up examination, three and a half years later, he declined to do so.

Case 17. J.S. Male. 62 years. Labourer.

History. Symptoms of chronic bronchitis and emphysema for many years. Six weeks before admission he had a sudden rigor with right pleuritic pain. Cough increased and he had muco-purulent sputum. He felt better after a course of sulphonamide and penicillin given at home but was referred because of a radiological opacity found at an M.M.R. unit. .

Physical Examination and Investigations. Typical signs of moderate chronic bronchitis and emphysema with numerous coarse crepitations over right upper lobe anteriorly. Early finger clubbing.

Chest radiograph. Patchy consolidation in the anterior and posterior segments of the right upper lobe and apical segment of the right lower lobe.

Bronchography. "Bronchitic" changes only.

Bronchoscopy. Negative.

Treatment. Penicillin and sulphonamide at home. Penicillin 2 mega units daily for ten days.

Result. Slow radiological improvement but with residual fibrosis in the right mid-zone at six months. At follow-up examination three and a half years later his bronchitic symptoms were no worse than before and the chest radiograph showed the same fibrotic changes in the right mid-zone.

Case 18. E.L. Male. 52 years. Maintenance Engineer.

History. Fever, malaise and cough with purulent sputum, which was initially blood-streaked, developed seven weeks before admission. He also had pleuritic pain in the right side. Four years previously he was found to have diffuse pulmonary fibrosis of unknown aetiology.

Physical Examination and Investigations. Typical signs of consolidation at the right apex with crepitations and occasional rhonchi on both sides. Marked finger clubbing. Epigastric tenderness. (He was known to have a chronic duodenal ulcer).

Chest radiograph. Diffuse fibrotic streaking on both sides, mainly mid and lower zones. Dense opacity in the apical segment of the right upper lobe. Tomography showed 2 cm. cavity in this segment.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms. A few colonies of staph. aureus (coagulase positive) on one occasion.

Treatment. Penicillin 2 mega units daily for one week, chloramphenicol 2G. daily for ten days, followed by penicillin 2 mega units daily for five weeks.

Result. /

Result. Slow radiological clearing. Tomography twelve weeks later showing "emphysematous cysts" only. At follow-up examination three and a half years later he had considerable disability from dyspnoea. Radiologically the diffuse fibrosis remained unchanged with increased opacity at the right apex.

Case 19. T.N. Male. 53 years. Van Driver.

History. He was referred from an M.M.R. unit because of a suspicious radiological opacity. Ten weeks before he had had an acute respiratory infection with cough, purulent sputum and tiredness. He had had mild bronchial asthma in the past.

Physical Examination and Investigations. Occasional rhonchi on both sides only.

Chest radiograph. Patchy consolidation in the right upper lobe.

Bronchoscopy. Negative.

Treatment. Penicillin 1 mega unit daily for ten days.

Result. Slow resolution with fibrosis persisting in the right upper lobe at six months. At follow-up examination three years later he complained of only slight wheeze and occasional cough. Fibrosis persisted in the right upper lobe.

Case 20. H.R. Male. 63 years. Retired Farmer.

History. Admitted with cough and purulent sputum of three weeks duration. He had lost weight but admitted to no other symptoms. He was known to have a chronic duodenal ulcer.

Physical Examination and Investigations. Medium crepitations in left mid-axilla. Early finger clubbing.

W.C.C. 6,200/c.mm.

E.S.R. 82 mm. in one hour.

Chest radiograph. Consolidation in the lingular segment of the left upper lobe. Small 1 cm. cavity within this segment.

Bronchoscopy. Pus was seen within the lingular segmental bronchus.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 2 mega units daily for five weeks. Chloramphenicol 2G. daily for one week.

Result. There was slow radiological clearing with closure of the cavity. Fibrosis was seen in the left mid-zone at six months. At follow-up examination three years later he had no complaints but fibrosis persisted at the left mid-zone.

Case 21. T.S. Male. 49 years. Bricklayer.

History. He had had symptoms of mild chronic bronchitis and emphysema for many years and "pneumonia" as a young man. Eight weeks before admission he became tired and listless and had increased cough, purulent sputum and dyspnoea but carried on with his work.

Physical Examination and Investigations. Signs of mild chronic bronchitis and emphysema only. Early finger clubbing.

W.C.C. 8,600/c.mm.

E.S.R. 9 mm. in one hour.

Chest radiograph. Consolidation with small cavity in posterior segment of right upper lobe.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 2 mega. units daily for two weeks.

Result. Slow resolution but with closure of cavity, residual fibrosis seen at six months. At follow-up examination three and a half years later he was well and regarded himself as a fit man, but minimal fibrosis in the right upper zone persisted on the chest radiograph.

Case 22. J.K. Male. 67 years. Labourer.

History. Two months before he had developed cough and blood-stained purulent sputum. He felt tired and cough and sputum persisted despite a course of penicillin given at home. In the past he had had only winter head colds.

Physical Examination and Investigations. Signs of consolidation in the right upper lobe.

W.C.C. 11,000/c.mm.

E.S.R. 2 mm. in one hour.

Chest radiograph. Consolidation/atelectasis in the anterior and posterior segments of the right upper lobe.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin at home for ten days, followed by penicillin 2 mega units daily for three weeks.

Result. Slow improvement with residual fibrotic streaking in the right upper zone at six months. When seen at follow-up examination three years later the chest radiograph remained unchanged and he was symptom free.

Case 23. C.M. Male. 46 years. Lorry Driver.

History. He had right-sided pneumonia in 1943 and had symptoms of mild chronic bronchitis and emphysema for some years. Nine weeks before admission he felt tired and generally unwell and one week later developed rigors, nausea and vomiting. Only slight increase in respiratory symptoms. Had penicillin for one week at home and felt better but on returning to work felt very breathless. Symptoms of acute bronchitis developed shortly before admission.

Physical Examination and Investigations. Occasional rhonchi and crepitations on both sides.

W.C.C. 7,500/c.mm.

E.S.R. 9 mm. in one hour.

Chest radiograph. Slightly contracted right lower lobe with consolidation in right middle lobe.

Bronchogram. Distortion of bronchi on the right side with bronchiectasis in the right upper lobe.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 2 mega units daily for five weeks.

Result. /

Result. Moderate improvement but persistence of opacity at six months. At follow-up examination three years later his bronchitic symptoms remained unchanged and the chest radiograph showed persistent fibrotic streaking in the right lower zone.

Case 24. A.S. Male. 46 years. Accountant.

History. He had symptoms of chronic bronchitis for many years and was known to have bronchiectasis in the right upper lobe with several episodes of pneumonia. There had been no increase in his usual cough and sputum but there had been increased opacity in the right upper lobe on the routine film. Sputum was negative for acid-fast bacilli. He was also known to have nephrolithiasis and idiopathic steatorrhoea.

Physical Examination and Investigations. Signs of mild chronic bronchitis and crepitations in the right upper zone.

Chest radiograph. Mottled opacities in the right upper lobe, associated with slight contraction.

Bronchogram. Minimal bronchiectasis in the right upper lobe with generalised bronchitic changes.

Bacteriology of sputum. Mixed U.R.T. organisms with a moderate growth of pneumococci.

Treatment. /

Treatment. Penicillin 2 mega units daily for two weeks, tetracycline 2G. daily for one month.

Result. Slow clearing of opacities in the right upper lobe but with residual fibrosis seen at follow-up examination three years later, when he had minimal respiratory symptoms.

Case 25. P. McG. Male. 60 years. House Painter.

History. Six weeks before admission he developed right-sided pleuritic pain, increased cough and purulent sputum. He had had symptoms of chronic bronchitis for many years and had been under observation for ? quiescent pulmonary tuberculosis.

Physical Examination and Investigations. Signs of consolidation in right upper lobe and mild chronic bronchitis. Increased nail-bed fluctuation.

W.C.C. 6,700/c.mm.

E.S.R. 20 mm. in one hour.

Chest radiograph. (Films could not be traced after referral to thoracic surgical unit but showed consolidation in the right upper lobe and a bronchogram showed bronchiectasis in the anterior segment of the right upper lobe and two large irregular areas of parenchymatous destruction in anterior and posterior segments).

Bronchoscopy. /

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms with moderate growth of *H. influenzae*.

Treatment. Penicillin 2 mega units daily for four weeks.

Result. Because of persistence of symptoms and radiological opacities, right upper lobectomy was performed four months after the start of his illness. When a follow-up examination was attempted it was found that he had died of ?respiratory infection.

Pathology of specimens. The bronchi were dilated and the lung showed extensive fibrosis and organising pneumonia. The few air containing spaces were lined by plump alveolar cells. (Fig. 10)

Case 26. H.S. Male. 56 years. Railway Porter.

History. Referred to hospital because of recurrent haemoptysis and found to have a radiological opacity. He had no other complaints apart from those of chronic bronchitis and emphysema which he had had for many years. He had chronic duodenal ulcer.

Physical /

Physical Examination and Investigations. Rhonchi over both lung fields, medium crepitations at right base.

Chest radiograph. Consolidation/atelectasis in the right posterior basal segment.

Bronchography. No definite bronchiectasis.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 2 mega units daily for ten days, tetracycline 2G. daily for one month.

Result. Slow radiological clearing with fibrotic streaking in the right lower zone at six months. Three years later at follow-up examination his respiratory symptoms were no worse than they had been before and the chest X-ray still showed fibrosis in the right lower lobe.

Case 27. K.W. Female. 56 years. Housewife.

History. She had had symptoms of chronic asthmatic bronchitis for many years and for a week before admittance had had tiredness, lassitude and sweating.

Physical Examination and Investigations. Occasional rhonchi on both sides, crepitations at right mid-axilla.

W.C.C. /

W.C.C. 12,000/c.mm.

E.S.R. 15 mm. in one hour.

Chest radiograph. Consolidation/atelectasis in the right middle lobe.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 1 mega unit daily for one week, tetracycline 3G. daily for one week followed by tetracycline 2G. daily for one month.

Result. Slow radiological clearing with fibrosis and slight contraction of the middle lobe at six months. No follow-up examination was possible three years later as she had emigrated.

Case 28. J.A. Male. 64 years. Engineer.

History. He suffered from chronic bronchitis and two weeks before admission had shivering, tiredness and increase in cough and purulent sputum. He was given sulphonamides at home with no improvement.

Physical Examination and Investigations. Typical signs of extensive consolidation on the right side.

W.C.C. 13,400/c.mm.

E.S.R. /

E.S.R. 93 mm. in one hour.

Chest radiograph. Extensive consolidation in the right lung with slight contraction.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms with a moderate growth of pneumococci.

Treatment. Penicillin 2 mega units daily for eight weeks, penicillin 2 mega units and streptomycin 1G. daily for two weeks, followed by tetracycline 2G. daily for four weeks.

Result. Slow radiological clearing with at six months contraction and fibrosis affecting mainly the right upper lobe. At follow-up examination three years later his respiratory symptoms were no worse than before and the chest radiograph still showed fibrosis in the right upper zone.

Case 29. M.J. Female. 30 years. Housewife.

History. Six weeks before admission she developed shivering, malaise and vomiting. Two days later she experienced right-sided pleuritic pain, cough and muco-purulent sputum. She also had night sweats and felt no better after a course of tetracycline. She had been on P.A.S. and isoniazid for several months for tuberculous cervical adenitis.

Physical /

Physical Examination and Investigations. Occasional crepitations in right upper zone anteriorly.

W.C.C. 9,000/c.mm.

E.S.R. 102 mm. in one hour.

Chest radiograph. Consolidation in the anterior segment of the right upper lobe.

Bacteriology of sputum. Mixed U.R.T. organisms with moderate growth of pneumococci.

Treatment. Penicillin 2 mega units daily for three weeks.

Result. Slow clearing with minimal fibrotic streaking in the right upper zone at six months. At follow-up examination almost three years later she regarded herself as entirely normal but the opacity in the right upper lobe remained unchanged.

Case 30. D.R. Male. 79 years. Retired Dairyman.

History. Symptoms of moderate chronic bronchitis and emphysema for some years. Five weeks before admission he felt tired and breathless but had no increase in cough. He was referred to hospital from an M.M.R. unit.

Physical /

Physical Examination and Investigations. Dullness to percussion, diminished air entry and crepitations at the left base. Early finger clubbing.

W.C.C. 10,700/c.mm.

E.S.R. 2 mm. in one hour.

Chest radiograph. Consolidation in the left lower lobe associated with a small pleural effusion.

Treatment. Penicillin 2 mega units daily for five weeks.

Result. Slow radiological clearing with persistent opacity in the left lower lobe and residual pleural thickening at six months. When asked to attend for follow-up examination almost three years later it was found that he had been confined to the house for some time with weakness and breathlessness.

Case 31. F.C. Male. 64 years. Cinema Attendant.

(This case has already been described in the section on illustrative cases).

Case 32. /

Case 32. C.R. Male. 51 years. Labourer.

History. A month before admission he had an attack of acute bronchitis and because of persistence of symptoms was referred to an M.M.R. unit, whence he was referred to hospital. In the past he had recurrent attacks of acute bronchitis.

Physical Examination and Investigations. A few crepitations and harsh vesicular breath sounds at the right lower axilla. Early finger clubbing.

Chest radiograph. Consolidation/atelectasis in the right middle lobe.

Bronchoscopy. Negative.

Treatment. Oral penicillin for one week followed by tetracycline for one week.

Result. Slow clearing with fibrosis in the right middle lobe at six months. At follow-up examination two and a half years later he had no respiratory symptoms and the chest radiograph remained unchanged.

Case 33. /

Case 33. J.L. Male. 57 years. Labourer.

History. He had had mild chronic bronchitis for many years. He felt very tired and had slight increase in his usual cough six months before admission. Cough became gradually worse and for three weeks he had anorexia, slight dyspnoea, night sweats and his sputum became blood-streaked. He was referred to hospital from an M.M.R. unit. He had symptoms of chronic duodenal ulcer but had remained well in this respect since 1949 when he had a vagotomy and gastro-enterostomy.

Physical Examination and Investigations. Signs of consolidation in the left upper lobe with a few rhonchi on both sides. Slight increase in nail-bed fluctuation.

W.C.C. 11,800/c.mm.

E.S.R. 50 mm. in one hour.

Chest radiograph. Consolidation in the anterior segment of the left upper lobe.

Bronchography. Distortion of anterior segmental bronchus of left upper lobe.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms. Profuse growth of coliform bacilli.

Treatment. /

Treatment. Penicillin 2 mega units daily for three weeks, followed by tetracycline 3G. daily for two weeks and 1G. daily for three weeks.

Result. He initially made clinical progress and there was radiological clearance but some five months later cough increased, sputum became purulent and tiredness and anorexia returned. The chest radiograph showed further consolidation. Because of this left upper lobectomy was performed.

Pathology. The consolidated area was a patch of organised pneumonia in which the alveolar spaces were occupied by fibrous plugs and the septa disorganised by fibrosis. (Fig. 9).

At follow-up examination two and a half years later he was well and the chest radiograph was satisfactory.

Case 34. P.T. Male. 59 years. Civil Servant (clerical)

History. He had developed shivering, anorexia and left pleuritic pain a month before admission. He was given chloramphenicol at home but one week later developed cough, mucoid sputum and lassitude and was referred to an M.M.R. unit.

Physical /

Physical Examination and Investigations. Slight dullness to percussion and diminished air entry over left upper lobe posteriorly.

Chest radiograph. Consolidation/atelectasis in the posterior segment of the left upper lobe.

Bronchography. Bronchiectasis in posterior segmental bronchus of left upper lobe.

Bronchoscopy. Negative.

Treatment. Penicillin 2 mega units daily for three weeks.

Result. After fairly rapid initial clearing opacity persisted at six months. At follow-up examination two and a half years later he complained of only slight cough and the chest radiograph remained unchanged.

Case 35. D.U. Male. 65 years. Retired Joiner.

(This case has already been described in the section on Illustrative Cases).

Case 36. A.B. Female. 69 years. Retired Typist.

(This case has already been described in the section on Illustrative Cases).

Case 37. /

Case 37. N.L. Male. 57 years. Warehouseman.

History. Developed flu-like illness three weeks before referral to a hospital outpatient department, where a right mid-zone opacity was found. He was given chloramphenicol but then developed fever, right-sided pleuritic pain, cough and blood-stained muco-purulent sputum.

Physical Examination and Investigations. Occasional crepitations over right upper lobe posteriorly.

W.C.C. 10,000/c.mm.

E.S.R. 42 mm. in one hour.

Chest radiograph. Consolidation in the posterior segment of the right upper lobe.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms. Moderate growth of *H.influenzae*.

Treatment. Chloramphenicol for one week, tetracycline 2G. daily for six weeks.

Result. Fairly rapid initial improvement for fibrotic streaking in the right upper lobe persisted at six months. At follow-up examination two years later he regarded himself as normal and the chest radiograph remained unchanged.

Case 38. J.B. Male. 60 years. Civil Servant.

History. Four years previously he had had pneumonia following prostatectomy for carcinoma of the prostate. Two months before admission he had an acute illness followed by malaise and confusion, slight cough and muco-purulent sputum. He received oral penicillin at home, but was referred to hospital because of persistence of symptoms.

Physical Examination and Investigations. Slightly impaired percussion note, harsh vesicular breath sounds and medium crepitations over right upper lobe.

W.C.C. 6,400/c.mm.

E.S.R. 52 mm. in one hour.

Chest radiograph. Patchy consolidation in a slightly contracted right upper lobe.

Bronchoscopy. Negative.

Treatment. Penicillin 2 mega units daily for two weeks, tetracycline 2G. daily for one week.

Result. Slow radiological clearing with minimal fibrosis persisting in the right upper lobe at six months. When asked to attend for follow-up examination two years later he declined to do so.

Case 39. M.L. Female. 59 years. Housewife.

History. Admitted six weeks after an acute respiratory infection with fever, lassitude and increase in cough and muco-purulent sputum. She had penicillin by injection for five days at home but was referred to an M.M.R. unit because of persistence of symptoms. She had had symptoms of chronic bronchitis for many years.

Physical Examination and Investigations. Numerous rhonchi and medium crepitations on both sides.

W.C.C. 9,000/c.mm.

E.S.R. 2 mm. in one hour.

Chest radiograph. Diffuse, patchy and streaky opacities on both sides.

Treatment. Penicillin for five days at home. Penicillin 2 mega units daily and streptomycin 2G. daily for one week followed by tetracycline 1G. daily for four weeks.

Result. Slow improvement of the patchy opacities but with persistence of the fibrotic streaking mainly in the right upper zone. At follow-up examination eighteen months later her bronchitic symptoms were no worse than before and the chest radiograph still showed fibrosis mainly in the right upper zone.

Case 40. J.B. Male. 52 years. Cooper.

(This case has already been described in the section on Illustrative Cases.)

Case 41. A.J. Male. 68 years. Coal Miner.

History. He had experienced cough, with mucoid sputum, weight loss and slight dyspnoea and was referred to an M.M.R. unit and from there to hospital. He had symptoms of mild chronic bronchitis and was known to have simple coal-workers' pneumoconiosis.

Physical Examination and Investigations. Occasional rhonchi on both sides. No finger clubbing.

Chest radiograph. Consolidation in the apical segment of the right upper lobe.

Bronchoscopy. Negative.

Treatment. Penicillin 1G. daily by mouth for one week.

Result. There was no change in the radiological appearances after four weeks and because of this and his symptoms segmental section was undertaken.

Pathology. /

Pathology. The specimen showed marked interstitial fibrosis, replacement of lung alveoli by fibrous tissue and chronic inflammatory cell infiltration. The remaining alveoli were lined by columnar epithelium. The bronchi contained pus and showed ulceration.

At follow-up examination one year later he was well and his chest radiograph was entirely satisfactory.

Case 42. W.P. Male. 58 years. Labourer (formerly Miner).

History. He was referred to a thoracic surgical unit from another hospital with collapse of his right, middle and lower lobes, cough, blood-stained mucopurulent sputum and slight dyspnoea. He was known to have simple pneumoconiosis.

Physical Examination and Investigations. Impaired percussion note, diminished air entry and a few crepitations over right anterior chest.

Chest radiograph. Consolidation in the right middle lobe.

Bronchography. Bronchiectasis in the right, middle and lower lobes.

Bronchoscopy. /

Bronchoscopy. Negative.

Treatment. Precise antibiotic treatment unknown.

A resection was advised but refused.

Result. There was only slight radiological improvement after six months. One year later a note of his progress was obtained from another hospital where it was stated that he remained quite well but that the right lower zone opacity persisted.

Case 43. E.D. Female. 67 years. Housewife.

History. She had been drinking heavily in a mood of depression following her husband's death and one week before admission became acutely ill with vomiting, cough and blood-stained purulent sputum. She also had Addisonian pernicious anaemia and peripheral neuritis (?alcoholic).

Physical Examination and Investigations. Typical signs of consolidation in the right upper lobe. Peripheral neuritis in lower limbs.

W.C.C. 1,500/c.mm.

E.S.R. /

E.S.R. 40 mm. in one hour.

Chest radiograph. Consolidation in the anterior and posterior segments of the right upper lobe. (Fig. 5)

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms. Moderate growth of B.coli. Scanty growth of coagulase positive staphylococci.

Treatment. Penicillin 4 mega units daily for six weeks followed by penicillin 1G. daily by mouth for two weeks, tetracycline 2G. daily for one week, penicillin 1G. daily for six weeks and finally penicillin 6 mega units daily for four weeks.

Result. Slow radiological clearing with fibrosis in the right upper lobe at six months. One year later she was well and had only slight occasional cough. The chest radiograph showed persisting fibrosis in the right upper lobe.

Case 44. H. McD. Male. 68 years. Retired Bank Clerk.

History. One month before admission he had an influenzal-like illness and was in bed for three weeks. He had slight pleuritic pain but he denied increase in his "smoker's cough" and he had no sputum. He had penicillin for one week at home.

Physical Examination and Investigations. Dullness to percussion and diminished air entry over left upper lobe anteriorly.

Chest radiograph. Consolidation in the anterior segment of the left upper lobe.

Bronchoscopy. Negative.

Treatment. Penicillin for one week at home.

Result. Fairly rapid initial clearing but slight opacity persisted at six months. When asked to attend for follow-up examination he declined to do so.

Case 45. W.R. Male. 56 years. Transport Worker.

History. He had suffered from chronic bronchitis for many years. Five weeks before admission he had an /

an influenza-like illness with increased cough and purulent sputum. He had pleuritic pain in the right side. He felt tired and lost weight.

Physical Examination and Investigations. Dullness to percussion, diminished air entry and a few crepitations over right upper chest posteriorly.

E.S.R. 41 mm. in one hour.

Chest radiograph. Consolidation with some contraction in the apical and posterior segments of the right upper lobe.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment and Result. He received no antibiotics and was considered on clinical and radiological grounds to have carcinoma. There was no change in the chest radiograph two weeks later and he was submitted to thoracotomy and segmental resection. Seen at follow-up examination one year later he was well and the chest radiograph was satisfactory.

Pathology. There was fibrosis or organisation of alveolar exudate, the remaining alveolar epithelium showing "foetalisation". There was infiltration with /

with plasma cells and lymphocytes and several small irregular cavities one of which contained a thick growth of fungus morphologically similar to *Aspergillus fumigatus*.

Case 46. G.S. Male. 52 years. Bus Driver.

History. He developed cough, blood-stained purulent sputum and left pleuritic pain six weeks before admission. He felt tired, anorexic and lost weight. Despite sulphonamides by mouth and penicillin by mouth and injection at home, he did not improve. He had symptoms suggestive of chronic bronchitis and mild emphysema.

Physical Examination and Investigations. Occasional rhonchi and occasional crepitations over both sides of chest. Dullness to percussion at left mid-zone posteriorly. Finger clubbing present.

W.C.C. 11,800/c.mm.

E.S.R. 36 mm. in one hour.

Chest radiograph. Consolidation with slight contraction in lingula and apical segment of the left lower lobe.

Bronchogram. /

Bronchogram. Distorted bronchi in left lower lobe and lingula.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 3 mega units daily for two weeks and 1G. daily by mouth for three weeks.

Result. There was slow radiological clearing with persistent fibrotic opacities in the left lower lobe at six months.

Case 47. E.R. Female. 33 years. Housewife.

History. She had had winter bronchitis as a child and adolescent but no other respiratory illnesses until five weeks before admission when she had sore throat, malaise, unproductive cough and sweating. Three weeks later she developed left pleuritic pain, cough became worse and she had slight haemoptysis. At home fever did not settle completely on tetracycline chloramphenicol, and penicillin and streptomycin.

Physical /

Physical Examination and Investigations. Dullness to percussion with diminished air entry and medium crepitations at the left base and lower axilla.

W.C.C. 9,400/c.mm.

E.S.R. 114 mm. in one hour.

Chest radiograph. Consolidation in the left lower lobe associated with small pleural effusion.

Pleural fluid. Neutrophil polymorphs; sterile on culture.

Treatment. 4 mega units daily for four weeks followed by penicillin 1G. daily by mouth for seven weeks.

Result. The effusion was aspirated and resolved completely. Clearing of the consolidation was slow but there remained only minimal fibrotic shadows in the left lower zone at six months.

Case 48. H.B. Male. 68 years. Retired Inspector of Taxes.

History. Six weeks before admission he developed headache, anorexia and cough with purulent sputum.
Cough /

Cough persisted and because of this he was referred for a radiological examination. He had symptoms of mild chronic bronchitis and three years earlier he had had left lower lobe pneumonia.

Physical Examination and Investigations. Dullness to percussion and a few medium crepitations at left base.

Chest radiograph. Consolidation in the right posterior basal segment.

Bronchoscopy. Negative.

Treatment. 1 mega unit daily for ten days and tetracycline 2G. daily for seven days.

Result. At the end of one month there had been no improvement in the radiological opacity and because of this he was submitted to thoracotomy and segmental resection. Four months later he was well and the chest radiograph was satisfactory.

Pathology. The specimen showed non-specific chronic inflammatory changes involving bronchi and peribronchial alveolar tissue with fibrosis and chronic inflammatory cellular infiltration.

Case 49. H.P. Female. 48 years. Housewife.

History. She developed fever and malaise followed by cough, purulent sputum and left pleuritic pain six weeks before admission. At home she received penicillin for ten days and tetracycline for one week with some improvement. She was referred to hospital from an M.M.R. unit. She was known to have mild diabetes mellitus.

Physical Examination and Investigations. Occasional crepitations at the left mid-zone posteriorly.

W.C.C. 5,800/c.mm.

E.S.R. 18 mm. in one hour.

Chest radiograph. Consolidation in the posterior segment of the left lower lobe. Tomography showed a 1 cm. cavity in this segment.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 4 mega units daily for three weeks and penicillin 1G. daily by mouth for six weeks.

Result. Slow radiological clearing with persistent opacity at the left mid-zone at six months.

Case 50. F.B. Male. 74 years. Coal Miner.

History. He had had chronic bronchitis and emphysema for many years and was known to have simple coal-workers' pneumoconiosis. Three weeks before admission he developed an influenza-like illness with cough, purulent sputum and right pleuritic pain. He did not improve with tetracycline at home.

Physical Examination and Investigations. Rhonchi and crepitations over both lungs with evidence of mild emphysema.

W.C.C. 10,000/c.mm.

E.S.R. 22 mm. in one hour.

Chest radiograph. Simple pneumoconiosis. Consolidation in the posterior basal segment of the right lower lobe and the lateral basal segment of the left lower lobe.

Bronchoscopy. Negative.

Bacteriology of sputum. Mixed U.R.T. organisms.

Treatment. Penicillin 3 mega units daily for six weeks followed by penicillin 1G. daily by mouth for three weeks.

Result. Complete clearing on the left side but persistent fibrosis at the right lower zone at six months.
